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ASIATIC SOCIETY.

Notes on the Bendkar, a people of Keonjur. By Lieut. S R Tickell, *Political Assistant, S. W. Frontier.*

In the course of my last annual tour through the Kolehan district, (January and February 1842,) I came upon a set of people, whose names and history we have hitherto been quite ignorant of, (even within the Agency,) and whose existence I only then for the first time ascertained. They comprise one insulated clan or tribe, not above 250 or 300 in number, and call themselves "Bendkars." Their habits and manners, in restricting themselves entirely to hills, assimilate them to the Kurriahs, a people well known in the mountainous districts, east and west of the Kolehan, and to be met with also in Birbhoom, but they deny any affinity to, or even knowledge of, the latter.

The Bendkars inhabit a small range of hills, called Bendkar Booroo, in the north of Keonjur, and close to Jamdapeer, (the southern border of the Kolehan.) The country is exceedingly wild, being in fact one uninterrupted sea of jungle, bounded to the N. and N. E. by the cultivated lands and villages of the Hos in Kotegurh and Burpeer, but whose limits in other directions have not been, nor probably ever will be, defined. These people have no separate language, but converse either in the Ho or the Ooria dialect, as occasion offers. In appearance they are much the same as the Bhooians of that part of the country, tolerably fair, well-made, and not devoid of intelligence; although from the excessive seclusion of their lives, they may be pronounced purely savage. By sending one of my chuprassees, with money and fair speeches, I was able to induce five or six of them to come into my camp in Sarndapeer. They were minutely questioned respecting their manners, customs, &c. but these appear to offer nothing particularly worthy of notice, being similar to those of other Semi-Hindoo tribes, such as the Bhoomijes, Bhooians, Sontals, &c. They worship *Kalee* and several tutelar *Deotas;* eat neither beef nor pork, drink water from a Ho's hand; but will not eat with them, nor would they touch food cooked by any Hindoo, even a Bramin. They have neither cattle, goats, sheep, nor pigs; but some keep a few head of poultry. Their houses are mere hovels formed of branches, leaves, and thatched with jungle grass, these are not built together so as to form a village, but are scattered by ones and twos about the base of the hill. Except on some few festive occasions, such as marriages, their manners are solitary and unsociable, and the poverty and misery of their mode of living almost surpasses belief, it being a common custom for a family to leave their hut in the morning, and pick up their entire subsistence for the day by grubbing in the jungle for roots, berries, hay, leaves of some species of trees; and then return as night falls, like mere wild beasts to their dwellings. When their scanty crops of maize, goradhan, (coarse rice) chunna, (gram), &c. are ripe, they fare somewhat better, and are occasionally able to bring some of the produce of their fields down to the nearest villages to barter for cloth. Their mode of cultivation is miserable; they earth up the furrows and water courses on the hill sides, and thus form small straggling *khets* or fields, which are liable occasionally to be washed bodily away, and should the crop attain maturity, the poor Bendkar is obliged to share it liberally with the wild pigs, deer, pea-fowl, and a host of such marauders, who help themselves at night to it, with impunity.

These people are not required to pay rent in money or in kind; but at the requisition of the nearest Sirdar, the Keonjur Raja's Dewan at Kalkapershaud, they a[illegible]able to be called upon as *begars*, or coolies, to assist in conveying the baggage of the Raja, or of any of his household in their annual visits to Juggernauth. These, a very few, are acquainted with the use of money, but the majority neither know nor value it.

The party with me consisted of three men, an old woman, a girl, and a boy; the two latter were pretty. They had never seen a "white face," nor indeed even a respectable or well-dressed native. They had never even heard the word "*Saheb*," nor knew its meaning. Every thing of course was therefore a novelty and a source of amazement; the tents, horses, elephants, the sepoys and suwars with me, all attracted eager attention, not a little mixed with alarm. Only one of them had ever seen a gun fired off, and the grand exhibition of a bird shot while flying past, afforded great astonishment and delight. With all this ignorance, these poor people were pleasing in appearance, clean in person, and decorous in manner. They looked on quietly and demurely at every thing, and after a visit of two days, rather joyfully took their departure, not being, I suspect, quite satisfied of their safety while in my camp, although much re-assured by dint of gentle usage and kindness. The suwars with their bushy beards and long scarlet coats, appeared to afford them much uneasiness, and must have enforced on their minds greater awe and reverence than my less imposing costume!

They burn their dead, but do not collect the ashes, nor destroy any of the deceased's property with his body, (as the Koles do.) Their marriages are simple, being merely the bridegroom taking away his bride to his house, when the parents of both sides have consented, and have both added their quota to the stock supplied for the maintenance of the couple. No crimes (at least public crimes) appear to be known among this people, and they have no chief, or person possessing any kind of authority, to punish such. The smallness of their numbers, and their confined locality is not satisfactorily accounted for, as they affirm they have been living on that hill alone for many generations. Nor to their knowledge, have their numbers been ever devastated by epidemic diseases. They are a perfectly peaceable race, never having been at issue with either Hos or Hindoos. They have arms, however, similar to those generally used in the country, which they employ in the chase.

The only specimen of their handicraft, which I procured from them, and which I beg, through you, to present to the Society, is the accompanying *plough.* It is used by the hand, as they have no cattle ; and is capable, as may be seen, of merely scratching up the surface of the soil. It is not handled in the manner of a hoe, or *fowra,* but dragged or scraped along, as far as the sweep of the arm allows : and it will be admitted, I think, that for barbarity, the instrument is unique.

NOTE.—The implement alluded to, is now in the Museum of the Asiatic Society. It is a rough hewn stick, nearly four feet long, which has been separated from the tree just below the off-shoot of a branch, at rather an acute angle with it, the off-shoot being cut down to about 10 inches long, and sharpened at the point, so as to take the ground like a rude pick axe : this is made more effective by an iron spike or peg, driven through the stick an inch or so above the off-shoot, and made to correspond in length with it. The cultivator using it, would, by dragging the implement towards him, have the soil, divided by the iron peg, and the furrow formed by the thicker substance of the off-shoot behind it.

Captain SHORTREDE, *in continuation of his Paper, p. 28, in No. 121 of this Journal.*

1. In continuation of our researches regarding the spherical excess in terms of the two sides and the contained angle, we resume the expression formely given $\tan \frac{1}{2} E = \frac{\tan \frac{1}{2} a \tan \frac{1}{2} b \sin C}{1 + \tan \frac{1}{2} a \tan \frac{1}{2} b \cos C}$ which may be otherwise written $\tan \frac{1}{2} E = \tan \frac{1}{2} a \tan \frac{1}{2} b \sin C \left(\frac{1}{1 + \tan \frac{1}{2} a \tan \frac{1}{2} b \cos C} \right)$; and the denominator within the parentheses may be expanded in the usual way.

2. For $\tan \frac{1}{2} a$ and $\tan \frac{1}{2} b$ substitute their values in arc to radius 1 by the formula $\tan \chi = \chi + \frac{1}{3} \chi^3 + \frac{2}{15} \chi^5 + \frac{17}{315} \chi^7 + \text{\&c.}$ and we have $\tan \frac{1}{2} a \tan \frac{1}{2} b = \left(\frac{a}{2} + \frac{a^3}{24} + \frac{a^5}{240} + \frac{17 a^7}{39720} + \text{\&c.} \right) \left(\frac{b}{2} + \frac{b^3}{24} + \frac{b^5}{210} + \frac{17 b^7}{39720} + \text{\&c} \right)$ and by actual multiplication we get $\tan \frac{a}{2} \tan \frac{b}{2} = \frac{ab}{4} \left\{ 1 + \frac{a^2 + b^2}{12} + \frac{6 a^4 + 5 a^2 b^2 + 6 b^4}{720} + \frac{136 a^6 + 63 a^4 b^2 + 63 a^2 b^4 + 136 b^6}{40320} + \text{\&c.} \right\}$ this expression and its powers being substituted in the expansion

of the original equation, becomes, $\tan\frac{E}{2} = \frac{ab}{4}\sin C \left\{1 + \frac{a^2+b^2}{12} + \frac{6\,a^4 + 5\,a^2b^2 + 6\,b^4}{720} + \&c.\right\} \left\{1 - \frac{ab}{4}\cos C\left(1 + \frac{a^2+b^2}{12} + \&c.\right) + \frac{a^2b^2}{16}\cos^2 C\left(1 + \frac{a^2+b^2}{6} + \&c.\right) - \frac{a^3b^3}{64}\cos^3 C\left(1 + \&c.\right) + \&c.\right\}$ by actual multiplication and reduction of terms with common factors, this becomes

$$\tan\frac{E}{2} = \frac{ab}{4}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{6\,a^4 + 5\,a^2b^2 + b^4}{720} - \frac{a^3b + ab^3}{24}\cos C + \frac{a^2b^2}{16}\cos^2 C + \&c.\right\}$$

3. For $\tan\frac{E}{2}$ substitute its value in arc $\frac{E}{2} + \frac{E^3}{24} + \&c.$ and transpose $\frac{E^3}{24} + \&c.$, and substituting for them their values in powers of the right hand quantity, $\frac{E^3}{24} = \frac{1}{3}\left(\frac{ab}{4}\right)^3\sin^3 C + \&c. = \frac{ab}{4}\sin C\left(\frac{a^2b^2}{48} - \frac{a^2b^2}{48}\cos^2 C + \&c.\right)$ then incorporating this and multiplying the whole by 2, we have

$$E = \frac{ab}{2}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{3a^4 - 5\,a^2b^2 + 3\,b^4}{360} - \frac{a^3b + ab^3}{24}\cos C + \frac{a^2b^2}{12}\cos^2 C + \&c.\right\}$$

4. The first term is the same as that for the area of a plane triangle having the same sides and contained angle: the following terms therefore shew the difference between the areas of the two triangles. Of these terms we may take account of as many as suits our object; but in ordinary cases it will be needless to regard any beyond the two first. Limiting ourselves to these, the difference between the areas of the plane and spherical triangles corresponds to an excess represented by $\frac{ab}{2}\sin C\left(\frac{a^2+b^2}{12} - \frac{ab}{4}\cos C\right)$ or by $\frac{ab}{24}\sin C\left\{a^2 + b^2 - 3\,ab\cos C.\right\}$

5. This expression shews that when C exceeds a right angle (cos C becoming −) the spherical area must exceed that of the plane triangle. When the two terms within the brackets cancel each other, the two triangles have equal areas; and when the second term exceeds the first, the spherical area will be less than that of the plane triangle.

6. The limits are easily assigned.

7. The sum of a and b being given, $a^2 + b^2$ is a minimum, and ab or $3\,ab$ is a maximum when $a = b$. In this case the triangles are isosceles, and $a^2 + b^2 = 2\,a^2$, and $3\,ab = 3\,a^2$; hence the terms within the brackets will cancel each other when $\cos C = \frac{2}{3}$, or when $C = 48° \, 11' \, 23''$. This for equal areas is the maximum of C. With isosceles triangles, if C be less than this, the spherical area will be less than that of the plane triangle.

8. Again when cos C is a maximum, C = 0: In this case, $a^2 + b^2 = 3ab$ or $1 + \frac{b^2}{a^2} = 3\frac{b}{a}$; the solution of a quadratic will give $\frac{b}{a} = \frac{3 + \sqrt{5}}{2} =$ 2·618 nearly. This is the maximum inequality in the sides so as to have equal areas.

9. In like manner may be found the value of the angle for any given ratio of the sides within these limits; or the angle being given, the ratio of the sides may be found.

10. The following Table shews for given ratios of a and b the value of C giving equal areas:—

$\frac{b}{a}$	Cos C	Log. cos C	
1·0	$\frac{200}{300}$	9·82391	48.°11′
1·1	$\frac{221}{330}$	·82588	47·57
1·2	$\frac{244}{360}$	·83109	47·20
1·3	$\frac{269}{390}$	·83869	46·23
1·4	$\frac{296}{420}$	·84804	45·11
1·5	$\frac{325}{450}$	·85867	43·46
1·6	$\frac{356}{480}$	·87021	42·08
1·7	$\frac{389}{510}$	·88238	40·18
1·8	$\frac{424}{540}$	·89498	38·16
1·9	$\frac{461}{570}$	·90783	36·01
2·0	$\frac{500}{600}$	·92082	33·33
2·1	$\frac{541}{630}$	·93386	30·50
2·2	$\frac{584}{660}$	·94687	27·46
2·3	$\frac{629}{690}$	·95980	24·16
2·4	$\frac{676}{720}$	·97262	20·08
2·5	$\frac{725}{750}$	·98528	14·50
2·6	$\frac{776}{780}$	·99777	·48

11. If the sides were so large in regard to the radius, as that the terms omitted could sensibly affect these results, it would be necessary to take those of the next, and perhaps also of higher orders.

12. To ascertain the actual difference in the areas of the spherical and plane triangles in an extreme case,* suppose an equilateral with sides of 1½ degrees: the direct formula gives the excess = 61.217; and the difference in the areas of the two triangles will be ·3951 square miles, corresponding to an excess of 0·″005245. One-third of this would be the difference on each angle, and were it ten times as great, it would still be, in Troughton's phrase, a quantity less than what is visible in the telescope.

13. It is almost needless to remark, that the supposed triangle is larger than any which has yet occurred in practice. The great triangle in the French arc, long supposed to be the largest in the world, has an excess of about 39″. I have had one observed by day-light on which the excess was about 41″.5. This least side was 80 miles, and the largest 92·6. Such a triangle does not often occur, but even this has only about ⅔ of the area of that on which the difference has been shewn to be utterly invisible.

14. But as the greatest difference occurs when C exceeds a right angle, we may find the particular angle giving the maximum difference by making $\frac{ab}{24}\left\{(a^2 + b^2)\sin C - 3ab\sin C\cos C\right\}$ a maximum by differentiating, we have $\frac{ab}{24}\left\{(a^2 + b)\cos C - 3ab\cos 2C\right\}dC =$

∴ the maximum corresponds to $\frac{a^2+b^2}{3ab} \cdot \frac{\cos 2C}{\cos C}$. This is an equation which scarcely admits of a direct solution, but the indirect solution is very easy.

15. As C is to be greater than a right angle, we may put $90+\chi=C$ $\therefore \frac{\cos 2C}{\cos C}=\frac{\cos 2\chi}{\sin \chi}$. As $\frac{a^2+b^2}{3ab}$ is always +, it is plain that χ cannot exceed 45°, nor be less than 0. Hence the quantity $\frac{\cos 2\chi}{\sin\chi}$ will pass through all its values from 0 to ∞ every half quadrant. By tabulating this, as under, for every degree of χ, we shall have by inspection for any ratio of the sides, the approximate angle giving a maximum difference of areas. A nearer approximation may be got by making proportion for the differences between the tabular and actual quantities in the usual way; and by computing another value on each side of the angle so found, we may by successive steps bring the approximation as close as we please.

	1·75788		0·48808	121	9 95977
	·45612		·45264	122	·91763
	·27881	108	·41798	123	·87320
	·15217	109	·38389	124	·82601
	·05306	110	·35020	125	·77546
96	0·97117	111	0 31674	126	9·72076
97	·90101		·28336	127	·66088
98	·83929		·24989	128	·59433
99	·78387		·21620		51901
100	·73332		·18212		·43160
101	0·68657		0·14750	131	9·32661
102	·64285		·11217	132	·19372
103	·60157		·07595	133	8·00980
104	·56226		·03864	134	7·70105
105	·52453		·00000	135	−∞

16. By means of this and the former Table, it appears that with equal sides the angle of maximum difference of areas is somewhat greater than 124°, and by another computation it will be found that the exact value is 124°·02′·35″ being the greatest angle giving a maximum difference of areas. For any other ratio of sides the angle will be smaller. For the ratio $\frac{3+\sqrt{5}}{2}$ the angle is 120°. When the ratio is $\frac{10}{1}$, the value of $\frac{a^2+b^2}{3ab}$ is $\frac{101}{30}$ and Log. $\frac{\text{Cos } 2C}{\text{Cos } C}$ is 0·52720, which corresponds to an angle of about 4′·25 less than 105, or 104°·55·′75; and so in other cases. When the ratio of the sides becomes indefinitely great, the maximum difference angle approaches indefinitely near 90.

17. In well chosen triangles, there are not usually any very great differences in the sides, and hence practically the greatest differences will usually occur when C is not far from 120°.

18. If for example we suppose a triangle with sides of a degree each, and containing an angle of 120°, by the original formula the excess is 27″·210 and the difference in area between the spherical and plane triangles is 0·18214 square miles, corresponding to an excess of 0″·0024176. On a triangle with degree sides and the maximum angle of 124°·02′·35″ the excess is 26″·035 the differences of areas 0·18320 square miles, corresponding to an excess of 0″·0024318. Such differences though utterly in-

visible in the telescope, are still much greater than have ever occurred in practice; for though single sides of more than a degree be nothing very extraordinary, it is but rarely that two such sides can be found forming a triangle with a third side of from 118 to 120 miles.

19. The difference here treated of is, in similar triangles, proportional to the 4th powers of the homologous sides: Hence, in an equilateral with half degree sides, this difference would be $\frac{1}{81}$ of $0''{\cdot}005245$, or $0''{\cdot}00006475$; and on the isosceles with half degree sides containing 120°, the difference would be $\frac{1}{16}$ of $0''{\cdot}0024176$, or $0''{\cdot}00001511$. Triangles such as these are not very uncommon, but it is much more common to have triangles with less than half of their area.

20. It is thus fairly proved that the difference between the excess on a spherical triangle computed rigidly, and that deduced by reckoning its area as equal to that of a plane triangle of the same sides and contained angle, is a quantity so small that, even in extreme cases, the neglect of it will induce no sensible error; and that in triangles such as usually occur in practice, the difference is so utterly insignificant, that to go much out of the usual way in order to take account of it, would be a very needless refinement.

Notes regarding the Meteorology and Climate of the Cape of Good Hope.

By Robert Trotter, Esq. *Bengal Civil Service.*

When last at the Cape it occurred to me, that a few particulars regarding the climate of a place, to which so many resort from this country in search of health, might be found interesting as well as useful: and particularly to medical men, by enabling them to judge how far it is likely to prove beneficial to those patients, for whom they may consider an absence from India necessary. If you deem the accompanying Meteorological Table, and the following cursory remarks worthy of a place in your Journal, I shall feel obliged by your inserting them.

The table contains an abstract I prepared from the Meteorological Registers of the Royal Observatory at the Cape, shewing the mean monthly weight and temperature of the atmosphere, and the minimum of each month for three years together, with the monthly fall of rain for the same period; and in order to compare the results with the climate of India, I have inserted corresponding observations made at Calcutta for an equal period, and likewise the monthly means of a year's observations at several other stations; viz. Darjeeling, Dacca, and Cawnpore, extracted chiefly from the *Journal of the Asiatic Society*.

The Cape observations were made at 3 hrs. 15′ P. M., being the period of least atmospherical pressure; the Thermometers hang on the South-east side of the building, in the shade, and protected from solar radiation; 4 P. M. is the hour of most of the Indian observations, a few only of those at Darjeeling having been made at 4 hrs. 30′ and 5 hrs. P. M.—the time of each set of observations therefore, being about an hour after the hottest period of the day, a rough estimate may be formed of the usual afternoon temperature, as well as a pretty fair comparison of the maximum temperature of the above places with that of the Cape, while from the means of the monthly minima, a comparison may be formed of the greatest average cold at the Cape and Darjeeling.

As Cape Town lies close to the base of Table Mountain, which, together with the Lion and the Devil's Peak encompasses it on three sides, its temperature is considerably higher than that of the Observatory, which is nearly three miles distant, and being situated on the low isthmus between False Bay and Table Bay, enjoys the benefit of the breeze which generally blows from one bay or the other.

The Camp ground, Rondebosch, and Wynberg, possess a similar advantage in point of situation over Cape Town, (from which they are distant from 4 to 8 miles.) They are the favourite abode of Indian visitors during the warm months, but as they lie nearer than the Observatory to the mountain, the weather is much damper, and the fall of rain considerably greater during the winter, than at that place. In the hot weather, however, they certainly enjoy a cooler climate, in consequence probably of the greater abundance of verdure and shade.

Table Mountain, and indeed the whole range of hills, of which the Devil's Peak is the northern extremity, produce a variety of interesting atmospherical phenomena, and often times occasion an entire difference in the state of the weather at Cape Town, which is situated on the west side, and at Wynberg and Rondebosch on the other side, of the range.

The north-west winds which prevail during the winter, are always loaded with much vapour, and bring much rain, but as the rain is frequently not formed till the vapour, after passing over Cape Town, has reached the cold summit of the mountain, it very often happens that though a fine day in Cape Town, it is raining heavily at Wynberg, Rondebosch, and other places on the lee side of the mountain. During the summer months, the same cause gives rise to a similar phenomenon, and occasions the well-known appearance on the top of the mountain, called the Table Cloth. The south-east sea breeze, which prevails at this season, unlike our Indian scorching hot winds, is cool and refreshing even in the hottest weather, and not being so highly charged with humidity as the northerly winds, the vapour it contains frequently passes over the mountain without becoming visible. Oftener, however, it is changed into a mist or cloud, which covers the top of the mountain, and is seen on the lee, or Cape Town side, rolling down in large fleecy volumes, till it reaches a warmer temperature, when it again becomes invisible. The elevation of this vanishing point varies with the hygrometric state of the atmosphere, and the line, thus formed, is so distinct that were degrees to be marked on the perpendicular cliffs which over-hang Cape Town, a gigantic, but correct hygrometer would be furnished. I may here express my regret, that I possess no notes of the hygrometric condition of the atmosphere of the Cape, sufficiently accurate to be recorded.

The different eddies and counter-currents of air produced by the influence of the mountain, and by the interruption it occasions to the general current of air, are also interesting phenomena. Among others, a remarkable one is often experienced by ships entering the Bay with a fair wind. On reaching a certain point they are frequently taken a-back, and find themselves in a strong breeze blowing right out of the Bay; and few who have lived at the Cape can have failed to observe occasionally, a northerly and a southerly wind blowing at the same moment in different parts of the Bay, a line of confused ripple clearly marking the limits to which the adverse winds, extend; and I may add another curious appearance I have repeatedly observed at Wynberg in winter, when north-westerly winds are bringing large clouds over the mountains; viz. a circular spot of blue sky in the direction of Constantia, about 10° to 15° in diameter, and about 20° from the zenith, on reaching which the clouds become invisible, but after passing it, they resume their former appearance. It may probably be accounted for by their meeting at that point a current of rarefied air, which having found its way through a neighbouring gap in the range of mountains, has not been cooled by passing over their summit. Those acquainted with these localities well understand that the gap alluded to, is that through which the road to Hout's Bay passes.

I may conclude these remarks, with a memorandum of the mean temperature of Cape Town, and three other localities in the interior, extracted from a printed statement I fell in with at the Cape, but I can neither attest its accuracy, nor explain how the means, there given, have been obtained.

" The mean temperature of Cape Town, inferred from a Meteorological Journal kept there for several years, is 67⅓°—the mean temperature of the coldest month is perhaps 57°—hottest 79°—mean of three recent winters 58°—of three summer months 77°—least heat during summer 63°."

" The temperature of the district of Stellenbosch deduced from the observations of a single twelvemonth is 66⅓°—extremes 87° and 50°. The temperature of Zwartland appears to be 66⅓°—extremes 89° and 54°—the exposure of the thermometers is at neither place external; they are suspended in spacious well-aired halls."

" At Tulbagh, situated in a valley of the great chain of mountains which divides the western from the eastern provinces of the colony, the mean temperature of the year is 66⅔°—that of the coldest month 55½°—of the hottest 80½°—extremes 94° and 92°—mean of the three winter months 56½°, of three summer months 79°; least heat in summer 61°."

CAPE OBSERVATORY.

Mean of Observations made at 3° 15′ P. M.

	1837-38.				1838-39.				1839-40.				Average.		
	Barm.	Ther	Min.	Rain Ins.	Barm.	Ther	Min.	Rain Ins.	Barm.	Ther	Min.	Rain Ins.	Ther.	Min.	Rain Inches.
July, ...	30.257	62.3	39.8	1.16	30.163	57.5	38.3	3.48	30.310	59.9	30.5	1.77	59.9	36.3	2.14
August, ...	.163	59.7	37.	1.81	.154	60.4	38.3	2.51	.157	59.6	36.4	2.72	59.9	37.2	2.35
September, ...	.418	60.3	39.	2.41	.141	61.2	37.	1.50	.196	62.7	43.7	0.49	64.7	39.9	1.47
October, ...	.168	65.5	40.5	0.45	.138	69.2	41.	0.24	.066	65.8	42.	1.80	66.8	41.2	0.86
November, ...	.081	59.3	48.4	1.24	.038	70.	50.3	2.39	.051	70.3	47.7	0.12	66.5	52.1	1.25
December, ...	.055	71.7	47.8	0.57	29.993	70.1	50.6	1.54	.031	70.1	52.8	1.60	70.6	53.7	1.24
January, ...	29.996	74.3	52.	0.0	30.057	73.7	52.5	0.12	.061	74.3	46.8	0.51	74.1	50.4	0.21
February, ...	30.004	75.4	52.8	0.6	.032	74.9	54.4	1.18	.012	73.8	48.9	0.28	74.7	52.2	0.51
March, ...	.071	72.	52.8	0.16	.099	71.8	49.	2.32	.050	74.1	47.8	0.00	72.6	49.9	0.83
April, ...	.101	67.8	47.5	1.22	.128	68.9	40.5	0.65	.071	68.	47.7	3.03	68.2	45.2	1.63
May, ...	.173	61.8	44.	4.33	.161	62.4	35.	2.19	.114	63.8	39.	1.68	62.7	39.3	2.73
June, ...	.174	59.5	36.8	5.53	.279	60.4	37.5	1.68	.205	58.5	39.4	4.20	59.5	37.9	3.80
Total fall of rain, ..	..	..	..	1948	..	..	..	1980	..	..	..	1820	..	..	1902
Yearly average Temperature, ..	.	65.8	..	..	..	66.7	..	..	..	66.7	..	..	66.5	44.6	..

	CALCUTTA. *Mean of Observations at 4° P. M.*							1837.		1840-41.	1834-5.
								Darjeeling.		*Dacca.*	*Cawnpore.*
	1836.		1837.		1838.		Average.	Mean Temp. at 4 P. M.	Monthly Minimum	Mean Temp. at 4 P. M.	Mean Temp. at 4 P. M.
	Barm.	Ther.	Barm.	Ther.	Barm.	Ther.	Ther.			1841.	1835.
January,	29.946	68.8	29.970	75.3	29.903	74.5	72.9	43.4	32.8	70.9	69.5
February,	.874	74.3	.919	81.9	.872	82.	79.4	45.5	34.2	58.8	74.7
March,	.787	83.9	.775	90.9	.757	89.5	88.1	55.7	43.1	82.	81.4
April,	.620	90.9	.639	94.4	.621	93.	92.8	60.2	48.1	89.1	92.1
May,	.542	95.9	.585	94.8	.574	96.	95.6	60.	50.	88.	100.
June,	.460	90.	.502	94.	.133	89.7	91.2	64.5	55.8	86.5	93.
July,	.504	86.2	.435	86.2	.448	86.8	86.4	63.5	57.3	76.	88.2
August,	.472	87.5	.508	85.7	.487	86.4	86.5	63.5	57.4	85.9	90.3
September,	.581	87.7	.613	88.2	.620	87.5	87.8	62.3	55.2	58.1	88.6
October,	.815	86 3	.753	86.5	.793	86.4	86.4	60.5	49.5	82.8	1834. 80.7
November,	.862	80.3	.864	80.7	.849	81.3	80.8	53.5	43.5	79.1	77.7
December,	.989	75.1	.933	75.3	.893	78.	76.1	47.6	39.9	1840. 70.4	71.0
Yearly average Temperature,	..	..	.	..	..	..	85.4	56.7	47.2	77.3	84.

Report upon the Manufacture of Steel in Southern India. By Captain CAMPBELL, *Assistant Surveyor General.*

The mode of making the Indian Cast Steel, or Wootz, is up to the present time a paradox with the learned of Europe.

Dr. Buchanan in his "Tour in Mysore," published the first account of the process, which he describes as fusing two pieces of iron in a crucible, two pieces of wood, and two green leaves.

In the 26th No. of the *Madras Journal of Science*, is given a reprint of a paper by Mr. Heath, with reference to a letter addressed by the Royal Society to the Right Honorable the Governor of Madras, in which he repeats Buchanan's statement, and speculates upon the theoretical action of the gases evolved from these two green leaves; but that he was unacquainted with the true principle of the process is made evident by his notice of Dr. Pearson's and Mr. Stoddart's opinions, that the steel is a natural product.

As supported by the opinions of good authorities upon the subject, it does not appear that any one has been sufficiently presumptuous to think of doubting the fact. This I, however, have taken the liberty to do, in some remarks published in the 6th No. of Dr. McClelland's *Calcutta Journal of Natural History*.

As it appeared to me that the native process of smelting iron was very rude and imperfect, and admitted of considerable improvement, without making such alterations as would be impracticable for the familiar use of the natives of India, I have had furnaces constructed, exact models of those in general use, and have had their process repeated, so that I might have opportunities of minutely examining every step of the process.

A result of my investigations, is, that the iron sand of India has the property, by a peculiar modification of the blast, and proportion of the fuel, of affording a natural steel of good quality as an immediate product of the ore, or what is technically called, a "natural steel," and on examining the common iron made by the natives from this ore, I find that it always contains $\frac{1}{4}$ of steel, and often one-half of its weight.

As the iron used at the localities mentioned by Buchanan is made, (to my knowledge,) from the iron sand, the above fact at once affords an explanation of the process so long paradoxical which is, that the supposed iron put into the crucible with the pieces of wood, and two green leaves, was two pieces of natural steel, which I have found by experiment in my blast furnaces to melt very easily.

This natural steel has the property of welding, from which the natives call it iron, and it must have been thus that they misled Dr. Buchanan; while cast steel, the only one they are acquainted with, falls to pieces like sand upon being heated to a white heat.

From its property of welding, this natural steel is peculiarly valuable for making axes, bill-hooks, and tipping plough shares, and the cheap rate at which it can be made (about 2 annas for 6 pounds) is of considerable consequence to the poor and labouring class of natives, as the only steel now procurable in India is sold at the rate of 3½ pounds for a rupee.

For coarse purposes, natural steel is imported largely into England from Germany, and Styria, and it is probable that from the cheap rate at which the above natural steel can be made in India, that it may prove to be a valuable article of export from South India to Europe; and as the granitic tract of the Barramahal affords inexhaustible quantities of the iron sand and fuel, there can be but little doubt of the possibility of the manufacture.

I have no intention of concealing the mode of producing the natural steel; but as my researches upon the subject are yet in a very crude state, and as much further investigation by chemical analysis is necessary into the composition of the iron sand, (which is a titaniferous mineral,) the various scorias of the furnace, and the compositions of the steel, and the theory of its formation, I shall reserve these particulars for a more complete report upon the subject.

Royacottah, 5th October, 1841.

Report upon the Improvement of the Silk manufactured in Mysore and the Salem Districts. By Captain J. Campbell, *Assistant Surveyor General.*

In the Salem district, silk is manufactured in small quantity, in Bairkay and Bangalore, and in a few small villages. In Trippatore it was formerly attempted to be introduced, but has failed for some reason not recorded.

In Mysore, silk is manufactured in much larger quantities, and it appears to be increasing very rapidly.

The manufacture is almost solely in the hands of the Mussulman population; and averse as the Mussulmans generally are to any field labour, or labour of any kind which requires much bodily exertion, the encouragement of this manufacture requiring but light labour, and only periodical attention, may prove valuable means of making productive a large proportion of the inhabitants of South India.

The quality of the silk as generally made is very bad, being simply reeled from the cocoons heated in a large earthen pot upon a large, rude reel, with four bars placed immediately over the vessel; and no attempt is made to remove the useless silk upon the surface of the cocoons, or to keep them clean from dust or dirt, nor to prevent the silk adhering by its gum upon the reel.

The value of the common silk various from two Rs. to three Rs. per seer of 24 Rs. weight, and it is principally consumed in the country at Wallujapet and Salem, where it is used in ornamenting the borders of cotton cloths, and for weaving into coarse silk cloths; and I believe that its quality is at present too bad to fetch any price whatever in the English market.

The demand for this inferior silk in the country must be limited; and it is probable that the only mode of increasing the manufacture is to increase the quality, so as to fit it for exportation to the London market.

It is well known that silk of good quality can be made in South India, from the fact of the manufacture being carried on at the present time by some European settlers.

The machinery used in Europe for reeling silk is beyond the means of the natives of India, who are generally very poor, but upon looking over the plan and drawings of these machines, it has occurred to me, that by a simple modification of the machine, I shall be able to construct them of cheap materials, upon a plan which may be probably made up by any one, even not a workman, for five rupees.

It is my intention to construct some reels upon this plan, and having proved their efficiency by experiment, to report again upon the subject, and to forward specimens of the silk manufactured with them.

The process of reeling silk is simple and easy, and the manipulation though delicate, is not difficult for any native to acquire; and there can be no doubt that if a few models of the improved machines were distributed, and a small establishment set up where they could be seen in use by those who choose to attend to learn the process, that the necessary information would be rapidly disseminated; for the indigent Mussulmans, in whose hand the manufacture now is, are generally very apt and intelligent, and unlike the Hindoo population, are quite sensible of, and ready to appreciate and make use of, the advantages of any improvement.

The principal difficulty in the improvement of the manufacture was suggested to me by one of these persons now employed in it, which is the difficulty of finding a market for the improved article at a remunerating price.

To produce an improved article, an increased expence must be incurred in labour, attention, and time, while a considerable loss of weight will result from removing the outer part of the floss upon the cocoons, and the dirt and impurities which are now reeled with the silk; and as the manufacturers possess no capital, and are so poor as to depend for a market upon the spot, they are obliged to sell the silk to the native *bukkals*, who will not give more than a very trifling increase of price, as the present consumers are not particular about the quality of the material.

To encourage the manufacture of an improved article, it appears to me that the only way will be to purchase it upon account of government, when it can be shipped to England, and sold as the products of the Bengal government filatures used to be.

It is not probable that any encouragement to the manufacture would ensue from allowing the Native Revenue Officers to effect the purchases, for it is probable that they would make them at a low rate, and debit the government with a higher, or if the disbursement of the money was not entrusted to their hands, that they would exact a premium from the sellers before they granted acknowledgments for the receipt of the silk upon account of government.

By appointing an European superintendent, who might travel about the country and examine the quality of the silk prepared, and make the purchases at stated times, disbursing the price himself, much of the objections might be obviated, as subordinate native examiners and purchasers might be employed under him, upon whom a sufficient check might be kept up.

The government price might at first be fixed very high, as high as

the selling price in London would admit of, as a premium rate; after a certain sum had been disbursed, proportionate to the extent of the manufacture, the government price might then be annually and gradually decreased until it became low enough to enable the merchants of Madras to enter into competition, and make their purchases from the government sales in this country; as the government price became still further decreased, the Native *bukkals* upon the spot would at last, by raising their prices to the highest they could afford to give, at last take the purchases altogether into their own hands, and the purchases upon account of government might cease; while any immediate and considerable fall in price might be prevented by the government price being offered whenever the selling price fell low enough.

Royacottah, 5th October, 1841.

MANIS CRASSICAUDATA., *(Auct.)*

M. PENTADACTYLA, *(Ibid).* SHORT-TAILED OR THICK-TAILED MANIS.

In Hindustan, generally called " Bujjerkeet."—Orissa, " Bujjer Kapta" and " Sooruj Mookhee."—By the Lurka Koles, " Armoo."—By Lieut. R. S. TICKELL, *Political Assistant, S. W. Frontier.*

Dimensions and description of a male specimen brought alive into hybasa, March 18, 1842, preserved and presented to the Museum of the Society, April 1842.

	Feet.	*Inches.*
Extreme length from muzzle to end of tail, ...	3	6½
Length of head, ...	0	4½
" of body, ...	1	8
" of tail, ...	1	6
From muzzle to inner corner of eye, ...	0	2¼
" Last to rim of ear, ...	0	1
Top of back to roots of claws, (of fore feet,) following the curve of the body, ...	0	11
Humerus, ...	0	3¾
Radius, ...	0	3⅛
Carpus to roots of fore claws, ...	0	1⅛

	Feet	*Inches.*	
Outer claw,	0	0¼	Measured as chords to the curve.
Next ditto,	0	1⅞	
Middle ditto,	0	2¼	
Index ditto,	0	1½	
Thumb ditto,	0	0¾	
Femur,	0	4	
Tibia,	0	3¼	
Os calcis to end of foot,	0	3	
Girth round body about its centre,	1	8	
Breadth of tail below at base,	0	4½	
Length of tongue, protruded portion,	1		

Teeth.—None. *Mammæ* 2, pectoral. *Clavicles* —

General aspect.—Body and tail thick, the latter much flattened, the section would be an obtuse angle, with curvilinear apex. Limbs short, stout, very muscular; the entire figure giving evidence of the enormous power of the animal. Head small, with elongated muzzle, a well shaped nose, (somewhat as in a dog), small mouth; eyes very small, placed far backward, and close to the ears. Ears small, with rounded helix, scarcely any tragus, exceedingly simple (externally) with a very small concha. The anterior extremities furnished with long stout claws, of which the outer ones are almost rudimentary. These claws do not expand (naturally) beyond at eight angles to the sole of the paw, the animal therefore in walking bends them in and treads on the knuckles, or rather on the roots of the claws. The five claws of the hind foot are small, barely touching the ground, and the foot resembles that of a tortoise, being oval, with a thick, cushion-like sole. General outline of the figure much hogged or curved on the back, with the tail pressed flat along the ground.

Tongue—Is flatly or sub-cylindrical ending in a depressed point, consisting of a central cylindrical part, and two outer flattened or laminous edges. The tongue can be drawn above a foot out of the mouth, but it is doubtful whether the animal can voluntarily protrude it to such a length. When so far extended, the skin of the tongue towards the root in returning appears to admit the tongue back into itself, so that the latter has the appearance out like a telescope. It is all over covered with a slightly viscid saliva.

Eye—Is small, dull, pupil circular, and as in bats or moles, barely distinguishable from the iris. A very strong opaque nictitating membrane. No eye-lashes to either lid.

Genitals (male).—A small longitudinal slit, in the apex of a rounded soft wrinkled bag, with the anus immediately behind. Testicles internal. No apparent penis. The belly and the under-surface of the tail being on the same plane, and the latter not capable of bending upwards, it is difficult to imagine how the Manis copulates: not improbably face to face.

External Covering—The upper part of the animal, and the outside half of each limb are clothed with horny sharp-edged scales, not very regularly disposed except on the tail. The nose is bare, and excessively tender; about ¾ths of an inch from it commence series of scales, extending laterally to within ½ an inch above each eye: these are small and hexagonal, and extend to the back of the head skirting the ears. From this point the scales of the back commence, they are looser, larger and more irregular in their order of imbrication; they are as nearly as possible disposed in eleven longitudinal rows, five on each side decreasing in size towards the belly, and one series along the dorsal line. On the tail are five series, the three central of which are regularly disposed. The scales of the lateral rows are bent or curved inwards, so that their long apices present a blunt edge along the whole length of the tail. In other words, these scales embrace or enclose the edge of the tail. The under part of the tail is flat, and covered with smaller rounded scales, which commence abruptly from a line about an inch in rear of the arms. The scales of the anterior limbs commence on a line down the middle of the inner side of the arm, from whence they diverge outwards and upwards, gradually assimilating (on the shoulder), to the order of the series on the back. The scales of the hind legs commence just below the knee, and the order of the series is downwards to the edge of the sole enveloping the outside semi-circumference of the limb. The nose, sides of the face, inside of the limbs, the entire thigh, and the whole of the under-parts to the root of the tail are naked and clothed with a soft whitish wrinkled skin. The soles of the fore-paws are smooth and flabby, (as they never touch the ground in walking.) Those of the hind feet, on which the animal rests, are black, tough, and spongy. The face is smooth, like that of a scalded pig, eyelids devoid of lashes. From behind the eye to the throat the skin lies in transverse folds or creases, of which the most conspicuous is formed by a continuation as it were of the helix of the ear, extending round the jowl. On the belly the skin lies more in longitudinal wrinkles. Between and underneath the scales on all parts of the body are brownish bristly hairs, few and scattered, here and there a solitary one visible.

Colour.—Eyes black, nose dirty reddish or flesh-colour. All the bare parts pale brownish-white, a little darker or smudged about the muzzle. The claws a pale-horn or brownish-white. The scales pale-horny or clay-colour, those on the head darker and shaded with a brownish neutral tint. Under the tail also the scales are washed with a blackish tinge. Soles of hind feet blackish.

Scales.—The shape of the scale is, for the most part, on the head, hexagonal: on the body a rounded four-sided outline. Some scales more semi-circular, others more pointed. But all or most, so jagged and broken as to be very irregular; on the tail they are more evenly semi-circular. The series on each side the tail present two planes or surfaces, being bent down along the middle, so as to cover both the upper and under-surface of the tail. The scales are generally smooth exteriorly with sharp edges, underneath they are more or less marked with transverse ugæ.

General remarks on the Viscera, &c.—On opening the body, the viscera did not present the irregular or peculiar formation and arrangement which might have been expected from so singular an animal, and the general appearance of the contents of the body struck me, as far as my limited knowledge of anatomy allowed, as very like that of the human subject. The heart, large, shaped as in man, with two auricles, and two ventricles. The lungs of proportionate size, and of a remarkably bright colour. Diaphragm exceedingly thick and tough. The liver, small, with two lobes, resting above the centre and right of the stomach, but not extending so far down as the latter. The gall-bladder exceedingly large, equal in size to that of a sheep. Pancreas and spleen situated as in man, and well proportioned. Kidneys very large.

The stomach shewed some remarkable peculiarities. The cardiac opening and pylorus apparently both on the same side, and close to each other. In the region of each, the stomach immensely muscular, having the appearance of the gizzard of rasorial birds. The left half of the stomach thin, membranous, and distended with wind. Œsophagus very small. The different parts of the intestines not distinguishable. There appeared to be a duodenum 8 or 10 inches in length, and the rest seemed to be ileum, being of the same size throughout, slender and much convoluted, till it ended in the rectum, which is very large. No cœcum was discoverable. The stomach is very large, extending almost entirely across the abdomen. The two muscular portions above noticed, felt to the hand as hard and round as racket balls, and rather larger in size. On opening the cardiac division, it was found to be full of gravel, quartz stones nearly half an inch long, the debris of large black ants, and a perfect bundle of intestinal worms. These were long, thin, cylindrical, semi-transparent, from one to two inches long, and pointed at either end. The muscular portion near the pylorus contained the debris of the ants, more digested and approaching the appearance of fæces, mixed and hardened by the mixture of gravel, but without the large stones. The left and largest portions of the stomach was a mere thin membranous bag, distended with wind, and here, as well as in the cardiac gizzard, and even in the œsophagus, the worms swarmed. The fæces of this animal when ejected are peculiar, being in the shape of black, shining, truncated cylinders, about $2\frac{1}{2}$ inches long and $1\frac{1}{2}$ in diameter. Void of smell, and dry, with no appearance of having been affected by bile.

The glandulæ renales large, and communicating by a duct, through a double glandular-looking perforated excrescence, into the urethra, not far from its mouth. No external parts of generation visible, except the opening of the urethea, which is prodigiously large. On either side, and within the skin are two well proportioned testicles; but no where could I detect the trace of a penis. Close in front of the orifice of the urethra, is a sinuosity or fall in the skin, resembling a shallow rudimentary sac. It appeared like a navel, but I could discover no communication from it inwards. These do not appear to be any secreting glands or follicles about the anus, although the animal emits a peculiar and offensive odour.

The subject from which these remarks are taken, died with its long tongue protruded, and for about 20 hours before dissolution it was unable to retract it. This prevented my being able to see the manner in which the tongue, when within the mouth, is folded up. But a great part of the basal portion, as before observed, appears to slide into itself, or into the outer skin of the tongue, and probably lies along under and in front of the œsophagus.

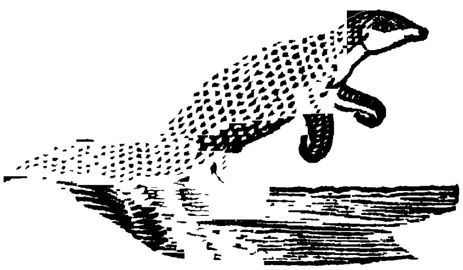
The process of skinning the animal for preservation was extremely toilsome and difficult, on account of the scales being deeply imbedded in the skin, which is indented throughout by them, the hollows so formed being filled up by the dorsal muscles. All the muscles and tendons are of great toughness, the flesh having a harsh and coarsely fibrous appearance. The pectoral muscles and those of the forearm and neck (platysma myoides) are of prodigious volume, and the latter covered with masses of fat, which I at first took for large conglomerate glands.

The bones are short, thick, and with reference to other animals disproportionably powerful. The dorsal and caudal vertebræ perfectly immense, ribs 13 pair, of which the last 5 pair false. The stout, solid sternum has its ensiform process elongated almost to the centre of the abdomen, or beginning of the umbilical region, that is, to where the umbilical region generally is, for in this animal I suspect the navel is quite close to the genitals. This ensiform process is in shape like a young plantain leaf, and has a thin pair of muscles spreading along each side of the centre or stalk. The skull is long and narrow, and apparently without sutures. The zygomatic arch small, lower jaw very weak; nasal bones much elongated, and suddenly truncated at the muzzle. The brain very small in volume. I was unable, from want of time, to examine with sufficient attention whether the animal possesses clavicles or not; my impression however is, that they are wanting.

Remarks.—The Manis is the rarest quadruped, I imagine, in India, owing perhaps as much to its habits as to want of numbers. During six years' residence in and near the forests of Singbhoom, I have only seen two living specimens. It is, however, not confined in locality, being known throughout Central India, where in the upper provinces it is called "Bajjerkeet." In Orissa and Bengal "Bajra Kapta" and "Sooruj Mookhee," and in the old Shunskrit still applied to many words further south, on the Peninsula, in the Madras presidency, "Vajra Keeta." By the Lurka Koles it is called "Armoo," and in the islands of the Eastern Archipelago, "Pangoe-ling." "It has been described also in our books of Natural History, under the name of Phattagen, and Manis." The Manis Crassicaudatus and M. Pentadactylus, (Auctorum,) are I suppose one and the same.

Habits, &c.—In Singbhoom the Armoo lives principally in the neighbourhood of rocks, from whence it rarely wanders. The specimen from which the present details were taken was captured on a pretty high hill. Of its manners very little is known, as the animal is strictly nocturnal, and its retreats, in the fissures of rocks, are so impenetrable, that I have never heard of the young being seen or taken. In Shaw's Zoology, in Geoffroy's Cuvier, and in other works, the Manis is represented upon a branch of a tree; but I very much doubt whether it possesses the power of climbing, although its fore claws are not unsuited to the purpose. Its food also, which consists of large black ants, is found as much upon trees as on the ground; but the weight and clumsiness of the animal impeded by a stiff tail which scrapes along after it, is repugnant to the idea, and of those people who have met with them in the jungles, none ever mentioned seeing one on a tree.

Quitting, however, doubts and conjectures, I shall content myself with describing the manners of two specimens I had alive for some days in my possession. One was brought to me in 1838. It had been captured by some Koles at dawn of day, on the ground, in a patch of low jungle or bush; being unable to progress beyond a slow trot, or to bury itself fast enough in the ground, it was easily taken. The animal has no means of offence; when handled or even approached it rolls itself into a ball, tucking its nose (the only part about which it appears solicitous) under its belly, folding in its legs, and wrapping the tail round all. When brought to me and laid on the ground, it remained for some time in this position, but at length cautiously unrolled itself, looking about and sniffing the air in all directions. The slightest noise, or knocking and scraping on the ground near it, would make it instantly resume its former position, from which the united strength of two men could not unwind it. If, however, left unmolested, it would after a little reconnoitring thrust forth, first one leg, and then the other, and so, starting to its feet, commence perambulating the apartment. In walking it stepped upon its knuckles, or more strictly upon the roots of its fore claws, which were bent closely inwards to the leg, the tail pressed to the ground. Its gait was slow and cautious, and the animal frequently reared itself on its tail and hind legs, as if to listen more attentively. In this posture it would remain either erect or at any angle with the ground, and nothing could give a clearer idea of the almost supernatural strength of the muscles of the back and loins, than the perfect ease with which the position was assumed and retained, a strength only equalled, in the animal world, by those species of caterpillars, well known to Entomologists, which sustain themselves for hours in attitudes which no other animal could endure for more than a few seconds. The annexed diagram will give some idea of this fact. The animal appears to be in an unnatural position, out of balance, and as if about to fall forward, but such is not the case, and the attitude here sketched is one I have often seen it assume, and sustain without the slightest apparent effort. On one occasion, while stumping about the room, the Manis passing under a heavy bookstand, containing four large shelves filled with books, (a weight which I do not think two stout men could have lifted off the ground,) tilted the whole affair up, so as to cause a general rush to the spot, to avert the threatened overthrow! Being left to itself in a large room, but precluded from going out, it made several tours of the apartment, and at length throwing itself on one side, commenced excavating into the wall, which was of sun-dried bricks, and in about two minutes had dug out a hole large enough to cover itself. In doing this it disturbed a colony of white ants, whose galleries ran along under the plaister, but I could not perceive that it paid them the least attention. It being impossible to chain the animal, as it suffered nothing to touch its head I kept it shut up in an empty beer-chest, the lid of which was rendered (as I imagined) secure, by large stones heaped upon it, to the amount of four or five maunds. In this manner I kept the animal about a week, during which it got pretty tame, seldom rolling itself up when touched or patted. It drank water freely at all hours of the day, lapping it up with its long tongue, and seemed fond of lying in it; but it took no food of any kind. Earth-worms, larva of kinds, and white ants were equally unnoticed; yet the animal appeared in no way weakened or suffering from hunger; and its weight, which was very



great, remain apparently undiminished. At last one night, it tossed off the ponderous lid placed on its box and made its escape, no traces of it being discoverable the next morning.

The second specimen I had in my possession, and which furnished the description here given, was brought me by some Koles in March 1842. It had been caught on a hill, at some distance from Chybasa, and in the midst of jungles. I had not unfortunately any opportunity of enquiring into the particulars of its capture. As I was then just about to leave Chybasa, I had it put into a box, and carried banghy fashion, along with my petarahs. During a three days' journey, it refused to eat anything, like its predecessor, but drank water. About the fourth day it began to grow more and more lethargic, remaining doubled up in its usual posture of repose. It was placed at night on a white ant hill; and at other times, black ants and larvæ were placed before it, but it refused nourishment, and after much protracted suffering, died during the night of the fifth day. Its tongue, which appeared paralyzed, remained protruded for the last 20 or 24 hours, till the end had become dry and shrivelled up. On being opened, there were found, as has been before related, swarms of intestinal worms in the stomach, which, and not starvation, might perhaps have caused its death, for there was a quantity of the remains of ants in the stomach, and the rectum was full of fæces. One hind foot of the animal had also been cut off, but the wound appeared an old one, though it still smelt offensively. The whole body, especially on the soft skin underneath, and between the scales, was covered with disgusting swarms of ticks, and the animal was altogether filthy in the extreme. Both these specimens (of which the first mentioned was much smaller) were perfectly gentle and harmless. The former one would when handled, hiss like a snake, and this was the only sound I ever heard either of them emit. They slept rolled up in a ball.

One of these animals, in the possession of Captain Hannyngton, Assistant to the Governor-General, South-west Frontier at Poorulia, that gentleman described as having been much larger than mine, and of a clear whitish colour. It also was never observed to eat any thing, although allowed to ramble about the garden, (under surveillance,) and eventually made its escape, which it effected, (curious to say,) in the same way, and under the same circumstances as did the first animal, above alluded to.

Hindoos ascribe great virtues to the scales of these animals in the cure of Hœmorrhoides, but how they are applied I know not.

The subject of these notes I had the honor to present to the Society's Museum on my arrival in Calcutta. And a few days ago while visiting the Museum, had an opportunity of seeing the skin of a specimen agreeing apparently with the animal described to me by Captain Hannyngton. In this skin, there is a slight variety or modification of form in the shape of the lateral scales of the tail, sufficient perhaps, (if established by an examination of two or three more specimens,) to constitute a new species. Mr. Blyth, the Curator, who brought this fact to my notice, will have, it is to be hoped, the opportunity of being able by and bye to examine more specimens of the kind, and thus establish a new species, or reject a mere accidental variety. The one I have been describing, I see no reason to suppose other than the Manis Pentadactyla, or Crassicaudata of authors.

Calcutta, April 16, 1842.

On the Theory of Angular Geometry. *By* S. G. TOLLEMACHE HEATLY, ESQ.

The following paper is intended to examine the properties of angular magnitude in a light, which has not hitherto attracted sufficient attention.

It is usual among elementary writers, to express the fundamental idea of an angle by the phrase—" mutual inclination of its containing lines." These are the words of Laplace in his Leçons at the Ecole Normale, and are in substance those of the great majority of Geometers before and after him. When, nevertheless, we have to eliminate any property relative to angles, it is well known that this definition becomes a dead letter; and it is found necessary to superadd an explanation which embodies as much more of the fundamental idea, as enables us to compare angles together. It amounts usually to saying, that angles are compared with each other by comparing the openings at their vertices: and that the magnitude of an angle depends on the *width,* and not on the *longitudinal extension* of that opening, if it may be permitted so to use the words in italics.

An advanced student, who has acquired the idea in question, will find nothing very objectionable in thus expressing himself, for he knows what is to be described, and mentally assigns a due scientific meaning to the general term of common parlance. But to the beginner, there appears something as vague in the word "inclination," as in the term "direction," when applied to a straight line. It even appears more vague, for the genus of a straight line is given—it is the *line* of direction: but the angle, is it then inclination itself? The student is apprised, that his attention is to be confined to points, lines, surfaces, and solids, things of which he has definite conceptions: but here at the very outset is a subject introduced, which appears to be distinct from all, and to be a *quality* of figure rather than an existence. It afterwards turns out that the only practically useful explanation relative to an angle requires merely, that it should *measure* this quality of position.

Considerations of this nature have induced some distinguishedly successful elementary writers, to deviate from the usual custom in seeking for such a definition of an angle as should appear to be a natural description of it, to be free from metaphysical objections, and to permit of *immediate* use in the investigation of the properties of angles, or failing that, through medium of such simple considerations as may appear almost axiomatically deducible from the definition.

Of this class is Bossat's statement, that the angle is the opening between two lines, with an explanation impressing the definiteness of the conception, and the mode of comparison naturally resulting from it. This was followed by Professor Young in England. But the nature of the idea thus attempted to be expressed by the word opening, did not seem to be yet satisfactorily developed, and Legendre, accordingly ventured to substitute "quantity" for "opening." The American edition of Brewster's translation calls an angle, "the quantity by which two intersecting lines are separated from each other;" and Francœur, I presume after Legendre, adopts a similar definition in his admirable *course.* It is, however, easily seen, that very little is gained by this step, on the score of clearness or precision, as the *kind* of quantity is not specified.

Leslie attempted quite another path, suggested by the cerelations of angles and arcs; viz., that angular magnitude is generated by the revolution of a line round a fixed point: but we are not told what angular magnitude *is*. All these definitions then fail in strictly fulfilling their object. Each has been in turn severely criticised by following reviewers, anxious to establish the validity of the most infallible of all—their own. But all agree in this; that they are descriptions of different characteristics of the same idea. If from any one we can obtain a definite conception of what is intended, we immediately perceive that all are sufficiently correct to recall it to our minds. All agree in understanding angular quantity to be "something," or if the expression be too bold, "that" which lies between two intersecting straight lines. All of them agree further in considering, that for purposes of comparison as to magnitude, angles must be estimated crossways, or by the width between the lines, and not with any reference whatever to the longitudinal extension in the direction of the sides.

Now, if we analyse the various definitions of an angle in this manner, it is, I think, impossible to come to any other conclusion than that an angle is the plane surface between two lines; of a peculiar nature, partly bounded and partly unlimited, whose value could *consequently* be only estimated by reference to the bounded direction, that is, the width between the sides. And the neatest and shortest mode of expressing this will apparently best solve our difficulty, as it connects axomatically an explicit definition with the working one.

The first place in which I believe this idea was embodied, was Bertrand's celebrated solution of the difficulty in the theory of parallels. The principle of that demonstration is as follows: Any angle, however small, can by repeated reduplication be made to exceed any given angle however great, but the band of *unlimited space* between two parallel lines, though repeated ever so often, will never fill up that given angle. Hence an inter-parallel space is less than any assignable angle in value, and therefore a line which cuts one of two parallels, must also cut the other, otherwise the angle which it makes with the one it does cut, would be wholly contained within the inter-parellel space, and be less than it. The stress of this demonstration evidently rests on the comparison of surfaces, and it is surprising that its extreme elegance did not lead Geometers earlier to seek the solution of the problem in that direction. The truth is, that the new "unlimited spaces" were treated as interlopers in the science of figure, and the demonstration rejected, as "wearing only the semblance of geometrical accuracy."

In Col. Peyronnet Thomson's* Geometry without Axioms, these unlimited spaces are for the first time distinctly enunciated. The fourth edition of that work contains the following paragraphs :—

" The latest innovation has been the assertion, that an angle (or " the thing spoken of by Geometers under that item, whether they knew " it or not) is a plane surface." Pref. page x.

" The plane surface (of unlimited extent in some directions, but limited in others) passed over by the radius vectus in travelling from one " of the divergent straight lines to the other, is called the angle between " them." " Hence," adds the Colonel, " angles are compared together " by their extension sideways only, without reference to the greater or " smaller length of the straight lines between which they lie."

After making this decided step however, Colonel Thomson stops; the definition is registered in his Book of Nomenclature, but he establishes the properties of angles by the old criterion of supposition. Not only indeed does the definition remain a dead letter, but the gallant radical reformer in Geometry as in Politics,

> " Astonished at the sound himself had made,"

virtually doubts its correctness, when at page 14, reviewing the proof of M. Bertrand, he says, " All references to the equality of magnitude " of infinite areas are intrinsically paralogisms."

The edition in question of " Geometry without Axioms," was reviewed in the 13th No. of the Journal of Education, in an article which betrays the sparkling pen of Professor De Morgan. The part relative to angles is noticed thus : " His is the first work, which we know, in which this " idea (that of a plane surface) is fairly brought before the beginner. " We suspect he is quite right, and that in the extension of the term " *equal* to unlimited figures which coincide in all their parts, will be " found the ultimate resting point of the theory of parallels. Had our " author stuck close to his definition, the demonstration of Euclid's axiom " given by M. Bertrand, ought to have been sufficient." After noticing the neglect of Colonel Thompson to make any use of his definition, as well as his attack on unlimited spaces, the reviewer proceeds: " We " wonder therefore that the definition should have been inserted, for it " is in the definition only, and the difficulty which a beginner must find

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* The well known Editor of the *Westminster Review*, and author of the *Corn Law Catechism.*

"in settling his ideas of greater, less, and equal on that definition, that "the whole objection to M. Bertrand's demonstration turns."

I have been minute in these quotations, not only because they contain all that to my knowledge has been developed on a very interesting subject, but also in the hope that they may draw further attention. Led independently to similar conclusions, by attempting to trace the natural affinities, if we may so term it, of geometrical truths, with the intention of forming a definite arrangement of them, I was induced to trace their consequences in establishing the various relations of angular space. The results of the inquiry may be thrown into a connected chain of propositions, as subjoined.

Definition 1.—The plane surface between two straight lines, bounded in the one direction, unlimited in the other,—is called an *angular space.*

Definition 2.—When an angular space is bounded on one side by the intersection of the containing lines, it is called an *angle.*

Definition 3.—The point of intersection is called the *verivx,* and the containing lines are called the *sides* of the angle.

Axiom.—From the definition, it will follow that two angular spaces A B C D, and E F G H, must be compared thus: If placing the line F E on B A, we find that, F falling on the point P, G will fall on some point Q in C D, then according as the line G H falls within, upon or without the line C D—is the angular space A B C D, greater than, equal to, or less the angular space E F G H. (Fig. 1.)

Definition 4, 5, 6.—Euclid's definitions of right, acute, and obtuse angles.

Proposition I.

Every angular space is equivalent to its angle.

This follows from the axiom, since the sides of the angular space, and of the angle are identical, and may therefore be considered to coincide.

Proposition II. *(Fig. 2.)*

All right angles are equal to one another.

Let the right angles A B C, E F G, be made respectively by A B with B C and E F with F G; they are equal. Produce C B to D and F G to H, and apply the figures one to the other, so as to make F coincide with B and G H with C D. If then F E do not coincide with B A, let it fall as B K. Then G F E = C B K ∠ C B A ∠ (its =) A B D ∠ K B D ∠ E F H.

But G F E = E F H by definition, hence the supposition, that F E does not coincide with B A involves absurd consequences, ∴ F E does coincide with B A, and G F E with C B A, G F E is therefore equal to C B A.

Cor. 1.—A right angle is therefore a *constant* in angular magnitude.

Cor. 2.—The space on one side of a straight line, considered as an angle at some given point in the line, is two right angles.

Scholium. (*Fig.* 3.)

Consider a line O A fixed, and another line O R, having a point O in common with O A, but being itself in a state of rotation round O. When in the position O R, it will have generated an acute angle A O B : as it proceeds, it will coincide with the perpendicular O B, and will have described a right angle. In the position O R_2, the angle generated is an obtuse one. The generating line then coincides in its progress with O C, the continuation of O A. It will in such position have described two right angles (A O B and B O C). Supposing the rotation to continue, O R will fall below O C, as O R_3, having described the whole of the coloured angular space, which is greater than two right angles. Such angle is called a *reverse* angle. During the progress of the line, the reverse angle continues to increase, equals 3 right angles, exceeds that amount, and at length equals 4 right angles, when O R has completed an entire circuit. By conceiving the line to move on, still revolving, and with the aid of a contrivance like the spiral twisted palm-leaf fans, used by the Natives, the beginner may obtain the idea of angles greater than four right angles, and generally of (2 n n̄ + A) which some find it difficult to understand in their later trigonometrical studies, and perfect acquaintance with which is so indispensable to the comprehension of periodic functions.

Proposition III. (*Fig.* 4.)

The vertically opposite angles made by two intersecting straight lines, are equal to one another.

The vertically opposite angles A E D and C E B made by the intersectors A B and C D at E are equal. For C E D being a straight line, the angular space on the side of it towards A is two right angles. For a similar reason, the space on that side of A E B towards C is equal to two right angles. These two angular spaces being constantly equal, take away from both the common angular space A E C, therefore the remainders are equal, viz. the angles A E D and C E B.

Scholium.

It may be useful to devote an angular space by *two* letters, one from each side, if the angle be less than two right angles, or by *three* if the angle be two right angles or more, to prevent the confusion of direct and reverse angles. Thus in Fig. 4, C B would stand for the angular space corresponding to C E B; A C B for the two right angles between E A and E B: and D A C B for the reverse angular space between E D and E B. The demonstration of III may then be made shorter, and perhaps clearer, thus: C E D being a straight line, D A C = 2 right angles; also because A E B is straight, A C B = 2 right angles, Hence D A C = A C B; take away the common part A C, then A D = C B. that is the angle A E D = C E B.

Proposition IV. *(Fig. 5.)*

If the angle contained by two straight lines is equal to two right angles, those straight lines form but one continued line.

For if A B, A C including an angle equal to two right angles, are not in the same straight line, let A D be the continuation of A B: then D C B is two right angles, but C B is the same by hypothesis, ∴ D C B = C B an absurd result; therefore A C and A B form but one line.

Proposition V. *(Fig. 6.)*

If any number of straight lines tend towards the same parts, the angle made by the extremes is equal to the sum of the angles made by the successive pairs of lines.

Let A, B, C and D be straight lines, tending towards the same parts, then the angle A H D is equal to the sum of the angles A E B, B F C, C G D formed by the successive pairs of lines. For the angular space A B C D is equal to the sum of the three angular spaces A B, B C and C D. But A B C D is the angle A H D and the constituent angular spaces A B, B C, C D are respectively identical with the angles A E B, B F C, C G D. Hence A H D = A E B + B F C + C G D.

Proposition VI. *(Fig. 7.)*

The three angles of a triangle are together equal to two right angles.

Let A B C be the triangle, produce A B, A C to E and F and the base B C both ways to D and G. Then since the lines D B, E B, F C, G C all tend towards the same parts, the angular space D E F G = D E + E F + F G. But D E is the angle D B E or its vertically opposite A B C; E F corresponds to the angle B A C and G F is the angle G C F or A C B. Also D E F G is the angular space contained by two portions of the same straight line, it is therefore two right angles. Hence

$$ABC + BAC + BCA = 2 \text{ right angles.}$$

Cor. 1.—The exterior angle is equal to the two interior and opposite on the same side, proved by reversing the process of Euclid in the 32. I. or as well thus (see *Fig.* 7.) The angular space E G is equal to E F and F G: E G = E B G; E F = B A C and F G = F C G = A C B

$$\therefore GBE = BAC + ACB.$$

Cor. 2.—Euc. I. 16 and 17 are further contained in the last corollary.

Proposition VII. *(Fig. 8.)*

The interior angle of a polygon of *n* sides are together equal to (2 n — 4) right angles.

Let A B C D E F be the polygon; subdivide it into triangles by lines from one of the points A. Then the angles of the polygon are equal to the angles of the triangle taken together. Each of the polygon, *save the two meeting in A*, corresponds to one of these triangles, therefore the number of triangles, is n — 2. And the sum of the angles in each is 2 right angles, ∴ the sum of all the angles is (n — 2) × 2 right angles. That is, (2 n — 4) right angles. Hence the angles of the polygon are equal to (2 n — 4) right angles.

Proposition VIII. *(Fig. 9.)*

The exterior angles of a polygon, whatever be the number of sides, are together equal to 4 right angles.

The whole angular space F G H K L F is composed of the angular spaces F G, G H, H K, K L, L F. But the whole space F G H K L F is the entire angular space on both sides of the line F E, i. e. 4 right angles, and each of the constituent angular spaces corresponds to an exterior angle of the polygon. Hence the exterior angles together amount to 4 right angles.

The above eight Propositions comprise all the properties of intersecting lines which are independent of the consideration of *length* and size. They shew how possible it is to translate the *spirit* of the principle of homogeneity from analytical into geometrical inquiries; for our *results* being altogether free from the comparison of triangles or the length of lines, the interweaving of those subjects in our *processes* raises a suspicion, that we are not proceeding so simply as we might do, but are embarrassed with matters really foreign to the direct truth. We might extend the same course to parallel lines.

Definition.—Straight lines that never intersect each other, are called parallel lines.

Proposition IX. (*Fig.* 10.)

If a straight line meet two others, so as to make the exterior angle equal to the interior and opposite on the same side, these two others shall be parallel.

Let C B E meet A B and D E making A B C = D E B, then D E must be parallel to A B. For the angular space D C = D A + A C and D C is D E C, and A C is A B C,

$\therefore$ D E C = D A + A B C, but D E D = A B C.

$\therefore$ D A is zero, or D E and A B contain no angle, therefore they never meet, for if they met, they must contain an angle; hence they are parallel.

Cor.—This proposition proves the possible existence of parallels.

Proposition X. (*Fig.* 10.)

If a straight cuts a pair of parallels, it makes an exterior angle equal to an interior and opposite one on the same side.

For as before D A C = D A + A C, but since D E and A B never meet, they contain no angle, i. e. D A is zero; hence D A C = A C or the angle D E B = A B C.

Cor.—It would be a waste of space to deduce from this, the other usual properties of parallels.

Proposition XI. (*Fig.* 12.)

Straight lines parallel to the same are parallel to each other.

A and B being each parallel to C, B is parallel to A. For A C = A B + B C, but A C and B C are each a zero, ∴ A B is also zero, or B parallel to C.

Proposition XII. *(Fig.* 13.*)*

If a straight line cut one of two parallels, it must cut the other.

A C, meeting A B, not meet *its* parallel G D, parallel to E D, consequently A C, A B being both parallel to E D, are parallel *inter se*, which is not the case.

The only other property of parallel lines not included in the above is, that two straight lines which are respectively parallel to two others contain an angle equal to the angle of those others. But there is nothing peculiar in its demonstration. These thirteen propositions contain a complete and homogenous *geometry of position* as contra-distinguished from that of *magnitude:* I speak of course relatively to lines. It is scarcely necessary to refer the student to the Third Book of Euclid, as far as relates to the consideration of angles in a circle, to shew how much this mode of treatment, and the introduction of reverse angles would simplify the subject, as well as prepare him for analytical inquiries by generalising his ideas on it.

POSTSCRIPT.

In looking over some of the mathematical articles of the Penny Cyclopedia, written by Professor De Morgan, I have subsequently to the writing of the above, found a confirmation of my views as to the nature of the angle under the heads, " Angle" and " Infinite."

The former proposes to introduce the axiom, that " two spaces whe- " ther of finite or infinite extent are equal, when one can be placed upon " the other, so that the two shall coincide in all their parts." After which it is remarked, that Bertrand's demonstration becomes rigorous. This also considers an interparallel space viewed as an angle to be zero, as I have done, since it is less than any assignable angle.

The latter has the following passage :—

" The comparison of such infinite spaces is therefore possible, con- " sistently with perfect clearness in the meaning of the terms employed, " and a simplicity of reasoning which would convince any one who is " capable of the most ordinary thought. Had Euclid been accustomed

" to the modes of thinking which involve the idea of infinite magnitude " under any form whatsoever, it may be reasonably suspected that he " would admit the following axiom, ***Magnitudes which can be made to " coincide in all their parts are equal,*** as applicable to infiniteas well as to " finite spaces. Not having done so, the adherence to his standard has " to this day excluded the only proof of the theory of parallels, which " does not assume the axiom of Euclid, or an equivalent."

Remarks on the Essay " on the Theory of Angular Geometry." By Capt. SHORTREDE.

A definition is perfect, when it includes all that has the property intended to be defined, while it excludes all that has it not.

If we would have a true definition of *angle*, or of any thing else, it is of the utmost importance that we have a clear idea of the thing, and then use such words as plainly to convey the idea. If there be any neglect in either of these, our definition must necessarily be imperfect.

Geometry as commonly defined, treats of *figured space.* If this definition be correct, (and I find no fault with it), then it is plainly improper to introduce indefiniteness, or boundlessness, or infinity, as part and parcel of the definition of a thing or idea, of which the property signified by these terms, is not ***necessarily*** a part. I can conceive of an angle formed by finite lines: unboundedness is therefore not necessary to the ***idea*** of angle, and therefore ought not to form a part of the ***definition.***

Since the idea of ***angle*** is somehow sooner or later convertible to, and commensurable by that of ***circular arc,*** every attempt at defining angle should be made with this in view, otherwise the definer will discover, (or some one will discover it for him), that his definition is not perfect.

As the author of this Essay introduces unlimitedness in the containing lines as part of his definition of ***angle,*** I do not see why the plane surface of a hyperbola between its assymptotes may not be angle, as well as the thing intended by him. If it be said, the meaning is the ***whole*** plane surface between the lines, I rejoin that the ***whole*** plane surface being unlimited, I cannot form an idea of how much it is.

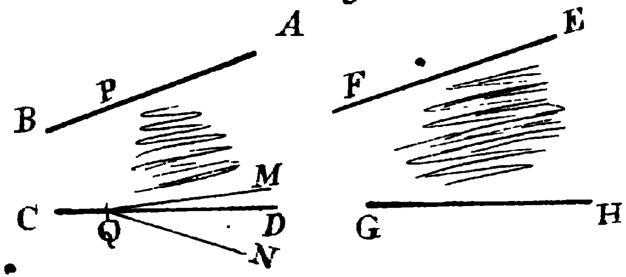
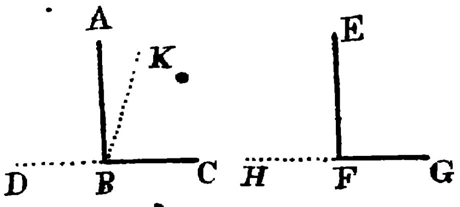


Fig 1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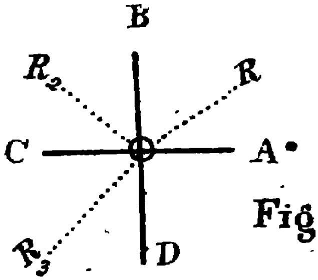
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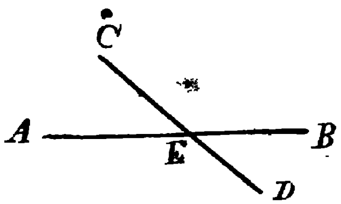
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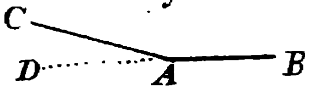
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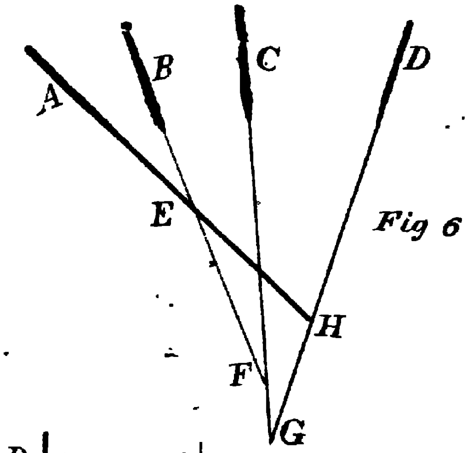
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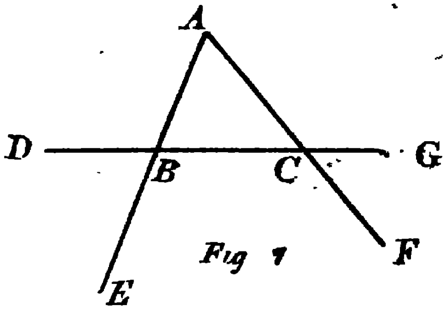
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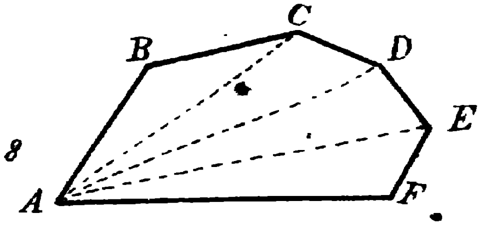
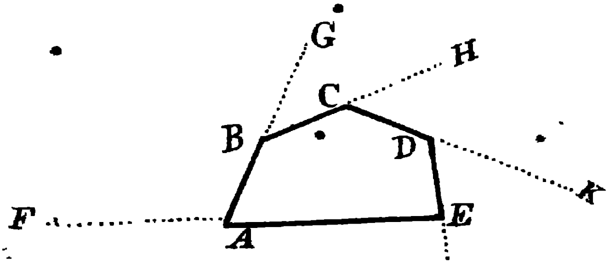


Fig 8



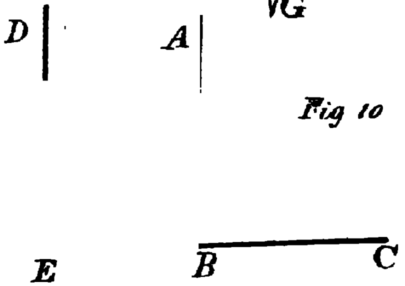


Fig 10

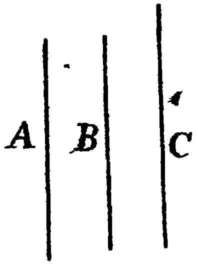


Fig 11

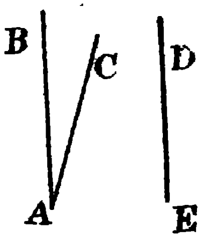
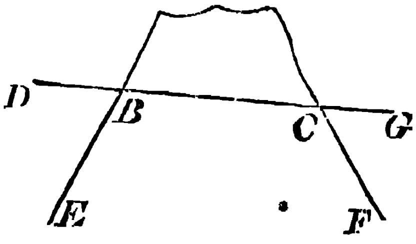


Fig 12

The definition has other faults: instead of saying "bounded in one direction, unlimited in the other," he should have said bounded in *two* directions, unbounded otherwise, (or elsewhere): for surely the thing meant is bounded by *two* straight lines, and therefore in *two* directions. Moreover, not unlimited, but *unbounded*, is the opposite of *bounded*. If any where, surely in geometrical definitions, it is indespensible that words should be used with strict propriety, so as to avoid confusion. With equal propriety it might be said, that the angle A B C + the angle B C D = the corner A B D.

As I hold that the definition of angle here proposed is a failure, so likewise is the demonstration of the property in Prop. VI., that the sum of the three angles of the triangle are equal to two right angles; and for the same reason. The space E F below the line D B C G may belong to the angle A, or to any thing else, as in the annexed figure.



Instead of systematizing and refining till we get our ideas into an atmosphere too sublime for them to be of any use, we may take in common sense view of the subject. In the triangle A B C lay a ruler on the line A B, marking the ends towards A and B with the corresponding letters. Turn the ruler about A, till the end marked B come into the direction A C; then let it turn about C, till the end A come into the direction C B; and finally let it turn about B, till the end B come into the direction B A. The ruler has thus turned about each of the three angles, and the ends marked A and B have changed places, shewing, that the sum of the three angles of the triangle are equal to quantity formed by turning a straight line half round, or to two right angles.

In like manner, if we measure the exterior angles of the triangle of any polygon, the ruler at last will have the same direction as at first, after having gone completely once round; or after having described four right angles.

If I were to write a Treatise on Geometry, I should without hesitation introduce these as demonstrations of the theorems regarding the interior angles of a triangle, and the exterior angles of any polygon. They have long appeared to me to be quite as evident and satisfactory as any principles in Geometry. A good treatise should be something like a good map, shewing not merely one high road through the country, but also the principal cross-roads connecting the different parts of the country with each other. In point of fact, no one is considered to be master of the subject, till he be pretty fully acquainted with these cross-connections.

We may chop logic as long as we please, but after all there is precisely the same difficulty in conceiving straight lines to be lengthened by producing them, as in conceiving angles to be increased by the continued revolution of one of the sides about a point, or by the lengthening of the circular arc measuring them. Each is accomplished by motion. The straight line is produced by another straight line laid partly upon it, and partly beyond it, or by conceiving the line to move along itself, all points between the fore-end of the old line, and the rear end of the new being common to both lines. In like manner, an angle or circular arc is increased either by a line revolving about a point, or by conceiving the arc to move upon itself, so as to have all the points between the fore-end of the old arc, and the rear end of the new arc, common to both arcs. In this way the idea of a fixed centre is unnecessary for any but the first part of the arc, just as the idea of a fixed direction is unnecessary for any but the first part of the straight line.

Notes on the Recent Earthquakes on the North-Western Frontier. By Lieutenant R. Baird Smith, *Bengal Engineers.*

On the forenoon of Saturday, the 19th of February 1842, a severe shock of an Earthquake was experienced at different points in the countries on our North-Western Frontier, and extending thence it affected, although with much reduced intensity, several of the districts of the North-Western Provinces.

The remotest point at which its devastating influence was experienced, and relative to which any authentic intelligence has yet reached us, was the city of Jellalabad, where extensive injury was done to the fortifications and to the buildings throughout the place. The motion of the earth is described as having been of an undulating character, producing symptoms similar to those of sea-sickness in many of the persons who felt it; and in one account it is asserted that the ground opened and closed again with loud noise in several places. Such a phenomenon is a very common accompaniment of a severe Earthquake, and by the extent to which it occasionally reaches, has proved one of the most fatal causes of destruction to life and property. The details of the effect of the Earthquake at Jellalabad are very brief and imperfect; this is, however, simply what might have been anticipated from the circumstances under which the gallant force now there are placed, but we shall probably at a future time obtain information of a more definite and satisfactory character. Three bastions, with, I presume, their connecting curtains, are said to have been levelled with the ground, and a painful interest is attached to this particular effect of the shock, from its having thrown open the defences of the small but resolute body of troops then occupying the city, and exposing them to an assault from the Affghans, at a time when they must necessarily have had much internal confusion to contend against. In darker times, superstition would have tended to unnerve still more our brave friends, but on this occasion their courage appears to have risen even above the level of their difficulties, and brilliant success in repelling the assault was no more than the well-merited reward of their devotedness and energy.

From Jellalabad the shock affecting a portion of the Suffied Koh range of mountains, with the numerous subordinate ranges that diverge from these, reached Peshawur. From the circumstance of General Pollock's force being encamped at Kawulsur, about eight miles from Peshawur, and the communication being uninterrupted, our details are much fuller, and more satisfactory, than would otherwise have been the case.

The following extracts from letters published in the *Delhi Gazette*, give the most perfect account of the different effects of the Earthquake that I have been able to find, although it is much to be regretted, that on the most important point, that namely, of the exact time of the occurrence of the shock, much discrepancy exists.

Extract from a Letter, dated Kawulsur, 20th February, 1842.

" Yesterday a fearful Earthquake visited this part of the world. The shock, which came on between 10 and 11 o'clock was long continued, and men, horses, tents, even the ground under us, and the hills in the distance, appeared to be moving. It was an awful visitation, and made every heart quake. In the direction of Peshawur, (eight miles distant,) clouds of dust appeared, which proved to have been caused by the falling of very many houses and buildings. A salute was fired from the battery at Jumrood, for the purpose of announcing the safety of Rajah Pertaub Sing, son of Maharajah Shere Sing, who is now at Peshawur, and of whom it is said, he narrowly escaped death; the building in which he had been sitting, came down almost immediately after he quitted it. The natives say, that a tenth of the city is down, and a number of the inhabitants killed."

Extract from a Letter, dated Kawulsur, 19*th February,* 1842.

" It is now about 12 o'clock mid-day, and we have just experienced a most awful Earthquake in camp. The natives say, that nothing so severe of the kind has been experienced in India for the last fifty years. The earth literally trembled like an aspen leaf, and rocked to and fro as an infant's cradle, or a ship at sea. Many of the camels that were carrying the baggage of the troops moving up to Colonel Wild's camp were thrown down, and so great was the shock, *which lasted fully five minutes*, that I was obliged to support myself by holding on to the camp furniture, and many of the officers fancied themselves suddenly taken ill. I expected every moment to have seen the earth open and swallow us up, and it is only by God's great and merciful providence, that we have escaped through such an awful convulsion of nature.

" Every one complains of nausea. We have just been observing immense volumes of dust, that completely darken the atmosphere in the direction of the old ricketty town of Peshawur, which is supposed to be nearly levelled with the ground, as the houses are but weakly built, being merely propped up by the beams of wood which may be observed placed in different spots under large walls and corners of the houses, and are even dangerous to passers-by at all times. I doubt not but that to-morrow's dawn will bring us dreadful intelligence, and produce a fearful account of lives lost.

20*th February.*—" Reports say, that only from 40 to 50 of the inhabitants of Peshawur were crushed and killed among the ruins of the falling houses. General Avitabile's large dwelling house, which had recently been built, and was being finished, fell in, but luckily it did no injury to any one living in the house."

It will be observed, that the writers of these interesting letters differ at least an hour and a half, or two hours in their estimates of the time at which the shock was felt at Kawulsur, the first placing it between 10 and 11 A. M., the other at noon. By comparing the periods of the occurrence at stations farther removed from the focus of disturbance, as at Delhi, Poojnah on the Doab Canal, Saharunpore, and other places, to which more specific reference will immediately be made, I am disposed to consider the first of these estimates as the most correct, and to fix the period of the shock at Kawulsur at very little after 10 A. M.

Travelling in an easterly direction, the next notices we have of the Earthquake is its being felt at Delhi, where its period appears from all accounts to have been about 10 minutes past 11 A. M. On reaching Delhi, both the intensity of the shock, and the rate of propagation of the undulations seem to have materially diminished; and beyond the motion of the ground, no other effects are alluded to.

Still continuing easterly, and in a direction very little removed from a right line between the two places, the shock travelled from Delhi to Poojnah, a station on the Doab Canal, where its effects were observed by Serjeant and Assistant Overseer J. R. Renny, and the following details connected with them were forwarded by him to me.

Extract of a Letter from Serjeant Renny, dated Poojnah, 19th February, 1842.

"I also beg leave to inform you, that we felt a very severe shock of an Earthquake here at about half-past 11 A. M., it lasted *about three minutes* with intervals. My whole family felt it, as well as the people about my place, who came running to me much alarmed. It was first noticed, I believe by myself, as I was then sitting writing, and found a heavy table on which my desk was laid, much agitated, which I thought was caused by some one moving, but I soon found my chair in motion also, and on looking about, I perceived every thing moveable in the room in a state of agitation. A few hours before this, I observed the water in the Canal was unusually muddy, and after the shock was over I went to look, and found the water much disturbed by a high swell, whether occasioned by the shock or not, I cannot say."

These details are unusually complete and interesting, and are very creditable to Serjeant Renny's powers of observation. The unusual muddiness of the Canal cannot possibly be due to the influence of the Earthquake, since the direction in which the shock travelled was against, not coincident with that of the current in the Canal, hence the disturbance of the silt in the bed could not *precede* the shock; but it is quite possible, that the high swell observed *after the shock had passed,* may have been occasioned by it. The muddiness was probably caused by a fall of rain in the upper part of the Canal.

From Poojnah the shock travelled to Saharunpore, where it was just felt, but attracted no particular attention. It was next experienced at Kulsea, another station on the Doab Canal, fourteen miles to the northward of Saharunpore, where its effects were very perceptible. The motion here, as described to me by Mr. Sub-Conductor Pigott, was of the same undulating character as at Kawulsur, but its duration was certainly not more than a minute. Immediately on observing the shock, Mr. Pigott ran to the sun-dial, and found it precisely noon, or 12 o'clock. My camp was pitched about two miles north of Kulsea, on the south bank of the Nowgong Row, (or Stream,) but so feeble was the intensity of the shock, that although I was conscious of some peculiar motion at the time, it never occurred to me that it arose from an Earthquake, and it had passed from my mind, till recalled by Mr. Pigott's account of what had been felt at the same time at Kulsea.

By combining the preceding details, some interesting points may be determined; and first, as to the rate of progression of the undulations. The maps I have had it in my power to consult, were not all so good as I could have wished, and the distances mentioned may possibly be a little incorrect, but not so, I believe, to any great extent. From Jellalabad to Peshawur, measuring in a straight line across the spurs of the Suffied Koh, the distance is 70 miles. From Peshawur to Ferozepore, measuring similarly in a straight line, the distance is 280 miles, and from Ferozopore to Delhi 250, in all 600 miles. The period of the shock at Jellalabad is not mentioned, but at Peshawur it may be taken at 10 A. M., while at Delhi it was 10 minutes past 11 A. M., hence then 530 miles were traversed in 1 hour and 10 minutes, or the shock travelled at a rate of 7.571 miles per minute, or 454.26 miles per hour. This, it is to be observed, is an average rate, and the velocity at Jellalabad and Peshawur was doubtless much greater, but a much more multiplied series of intermediate observations than we now have, would be necessary to enable us to form even an approximative idea of the law of decrement of rate of progress with reference to distance travelled. From Delhi to Poojnah is about 50 miles, and the times consumed in travelling from the one place to the other was 20 minutes, consequently the velocity of the shock was 150 miles per hour. Again, the distance from Poojnah to Kulsea is very nearly 36 miles, and the time 30 minutes, so that the velocity had diminished to 72 miles per hour, supposing the times to have been correctly observed, which, within a small limit, was probably the case. Hence then we have,

	Miles.	
Rate of progress of shock from Peshawur to Delhi,	454.26	per hour.
,, ,, from Delhi to Poojnah,	150	ditto.
,, ,, from Poojnah to Kulsea,	72	ditto.

We may next attempt to form some estimate of the breadth of the undulations, of which there appear to have been several, although no data are furnished, from which we can learn either their number or individual extent. We must therefore content ourselves with estimating the total breadth of the zone of disturbance, as it may be called, at different points.

The duration of the shock at Kawulsur is said to have been 5 minutes, and supposing the velocity to have been there twice the average between Peshawur and Delhi, or 15.142 miles per minute, the breadth of the disturbed zone would be 75.71 miles, or in five minutes, a series of terrestrial waves, whose united breadth was this number of miles swept past Kawulsur. This is a horizontal measurement; but of the vertical height of the waves, on which their destructive influence chiefly depends, we can form no estimate, yet it must have been considerable, if we may judge from the ruin caused.

At Poojnah, the duration of the shock was considered to be three minutes, the velocity 2.5 miles per minute, and therefore the breadth of the disturbed zone was here 7 miles. While again at Kulsea, where the duration was one minute and the velocity 1.44 miles per minute, the breadth was 1.44 miles.

Whence we have,				*Miles.*
Breadth of zone of disturbance			at Kawulsur,	75.71
,,	,,	,,	at Poojnah	7.00
,,	,,	,,	at Kulsea,	1.44

Whatever may be the effective cause of Earthquakes, whether undulatory motion communicated to internal masses of fluid matter, and from thence communicated to the super-imposed crust of the earth, or vibrations propagated from foci of disturbance through the solid crust itself, or a combination, as some facts would intimate of both these causes, there are two modes in which we may conceive these motions to be spread abroad. First, they may proceed in gradually enlarging circles, (as when a stone is thrown into water,) the focus of disturbance being the common centre; or they may be propagated along a distinct and defined track, (as when a string or wire is seized at one extremity and motion communicated to the whole from this,) when the focus of disturbance would be at one end. In the first case we would expect the effects of the Earthquake to be felt at points equi-distant from the centre at times approximating, but not exactly coincident both with each other, as the rate of progress of the undulations would necessarily be affected by the nature of the rocky crust through which they were propagated. In the second case, we would expect, that while the effects of the shock were more or less severe within certain limits, beyond these limits none would be experienced. All the information I have been able to collect tends to shew, that the Earthquake of the 19th February 1842, belonged to this latter class, and if lines be drawn through Peshawur, Ferozepore, &c. with parallels through Jellalabad, which as yet forms the southern limit of the track, it will be found that the breadth of the district affected by the shock was somewhere about 40 miles, and in it are included the mountain ranges to the south, east, and west of Peshawur, with a considerable portion of what has been called the Salt range. This estimate has been formed solely from the facts collected by myself, and it may yet require to be much modified as our information extends. The method of what may be called the linear, in contradistinction to the circular propagations of Earthquake shocks, appears to me to lead very distinctly to the conclusion, that in such cases, the original seat of the disturbing forces must necessarily fall short of the centre of the earth, and also be unconnected with any such continuous fluid nucleus, as many suppose to exist at no very great distance from the surface. When from the action of any disturbing cause, the equilibrium of a continuous fluid mass was deranged, the resulting motions would be communicated in all directions radiating from the point of original disturbance, and if this was near the centre of the earth, the movements ought to affect its whole surface, so that shocks would be experienced nearly simultaneously over the whole world. But however extensive may be the connection of certain Earthquakes on record, we have nothing approaching to any such universality of effect as this, and the theory of local action (using this expression in a large sense) appears to agree best with the present state of our knowledge relative to the phenomena of Earthquakes and their causes.

On the night of the 5th of March, 1842, another very severe shock was experienced, which appears to have been more limited in its range than the preceding, and exhibited essentially distinct phenomena. The motion in this instance, instead of being like the rounded swell of a fluid or viscid mass, was sharp and sudden, like the effect of a concussion, than of an undulation, and seemed indeed to be a much magnified "jarr," similar in kind to that experienced by the hand when a hammer held by it, is struck forcibly on a hard unyielding body. One intelligent friend, who was in his study when the shock occurred, described the effect to be, as if he and his chair had received a sudden and severe blow from behind, by which they were impelled forward, while to me, it seemed as if my chair had been suddenly lifted from the ground, and dashed down again with great force.

The following interesting detail of the effects of the shock, as experienced at Berkeri, a station on the Doab Canal, about 20 miles south of Saharunpore, was communicated to me by Serjeant and Overseer J. Petrie, to whom I feel much indebted for the trouble he has taken in preparing it.

Letter from Serjeant John Petrie, dated Berkeri, 5th March, 1842.

Sir,—We had a very smart shock of an Earthquake here at 9 o'clock this evening; so much so indeed, that every thing in this bungalow shook and rattled again. I had just laid down to rest with a book in my hand when it came on, and I started up and called out for assistance, thinking the house was coming down. Every one about the place felt it, and came running to me. I found that the south door of the inner room, which I had bolted before I went to bed, had been forced open by the bolt falling down. Indeed every thing in the house shook, and I was very much afraid of its falling, after having read the accounts from our Army near Peshawur. At that place, a number of houses have been destroyed, and many lives lost, from the last Earthquake.

Although this shock did not last so long as the one of the 19th of last month, in my opinion it was much more severe for the time.

The rate of propagation of this shock appears to have been great, since no perceptible difference was observed in the times of its arrival at the following places: Simlah and Mussoorie in the Himalayas, Deyrah in the Deyrah Dhoon, Saharunpore, and Berkeri. There is, therefore, every reason to think, that on this occasion the shock was propagated after the circular method, as I have defined it above, and the nature of the shock appears to indicate, that the seat of the disturbing force was either within the rocky crust of the earth, or at a very small distance indeed beneath it. Such a supposition is necessary to account for the peculiar "jarring" sensation characteristic of this shock. Its effects appear to have been most severe at Deyrah, where a large house is said have been split from top to bottom, but no particulars of this accident have reached me. I am somewhat disposed to think that the actual force of disturbance was situated somewhere in the valley of Deyrah, and propagated thence to the hills on one side, and to the plains on the other; a more extensive collection of facts would however be necessary to give probability to this impression, and these have not in this instance been collected. It may be stated, however, that all who had experienced both shocks in this neighbourhood, concurred in opinion that they came in different directions, and as the first was from West to East, it is not impossible the second may have been from North to South. The southern door of the inner room of the Berkeri Canal bungalow, which is stated by Serjeant Petrie to have been driven open by the shock, would on the above supposition receive the first impulse, and the effect produced upon it, tends in some measure, to confirm the view I have taken of the direction in which the shock was propagated.

The occurrence of Earthquakes throughout these provinces, and indeed throughout India generally, is so frequent, and their connection with geological theories of such an interesting character, that it is highly desirable to facilitate, as much as possible, the collection of minute, well authenticated, and carefully detailed facts relative to these various phenomena. I will therefore conclude this note, by pointing out briefly those points on which information is peculiarly desirable, and the attention of observers is earnestly solicited to them.

1. *The Time.*—The startling discrepancies that occur in regard to time, in otherwise most satisfactory accounts of Earthquakes, indicate the great necessity for precaution in observing it, since it is undoubtedly the point on which the most interesting conclusion relative to such occurrences must be based. When, therefore, the period of a shock is marked by a watch, means ought to be taken, whenever possible, to verify the time shewn by this watch, by some simple celestial observation, or some data should be given by which the time could be ascertained independently within very trifling limits, as for example, by a specification of the exact length of the shadow of a vertical object of fixed and determinate length, on a horizontal level, at a precise moment, not too near noon; or if near the coast or at sea, the first appearances and last disappearances of the sun's upper and lower border, above and below the sea horizon, etc.[*] Without this minute identification of time, it is impossible to maintain the connection of shocks felt at far distant places; calculations of the rate of progress of the undulations or vibrations can only be approximative, and other interesting points are rendered inconclusive.

2. *The Duration.*—On this point also, the most striking discrepancies are to be observed, arising no doubt from each observer making his own sensation the measure of duration, and estimating the latter without reference to some determinate standard. When the mind is intently occupied either by feelings of alarm or intense interest, it is wholly unfitted for estimating duration correctly, and the watch ought only to be trusted. The general tendency is to make the duration

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[*] Sir J. Herschell's Meteorological Instruction, Prof. Papers, Roy. Engrs. vol.

of shock longer than it really is, and in most instances, considerable deductions might with safety be made from recorded observations on this point, to bring them near the truth. The duration of intervals between shocks should also be carefully noted.

3. *Nature of the Shocks.*—This is very frequently twofold: one kind throws the crust of the earth into a tremulous state. This was the nature of the shock of the 19th February. The second kind is of the nature of a concussion or blow, and does not always occur. Sometimes both of these are conjoined in one and the same shock, and the latter is felt generally in the middle of the former.

4. *Nature of the motion on the Earth's surface.*—Three different varieties of this have been observed. First, a horizontal motion by which bodies are, as it were, pushed horizontally forward. Second, a vertical motion by which they are lifted up and dashed down again. The conjunction of these two kinds of motion produces the third, which is of an undulatory character, partaking both of the horizontal and vertical movements. This kind is the most frequent of all, and produces those sensations of nausea, so commonly alluded to.

5. *Rents in the ground and subsidencies* are very common accompaniments of Earthquakes, and their appearance ought to be represented on paper, and their dimensions carefully measured. These are often accompanied by *loud noises* of various kinds.

6. *Meteorological phenomena* are highly important, and some curious and interesting relations have been observed, between these and the occurrences of Earthquakes. This is especially true as regards the state of the barometer and thermometer, and the electric condition of the atmosphere. Such points therefore merit peculiar attention.

7. *Geological structure of affected District.*—When the observer is qualified to furnish information relative to this, his remarks will be additionally important, as it has been observed, that in localities exhibiting certain geological features, Earthquakes always occur with much greater frequency than in others. Wherever powerful and extensive volcanic action has occurred, where faults and fissures communicating with the internal seats of disturbing forces are found, there Earthquakes occur with greater frequency and higher intensity, and they are frequently observed to pursue a direction, parallel to that of the principal faults or fissures.

8. *The direction of the Shock.*—I am not aware of any instrument having yet been actually employed for ascertaining this point, but the following simple apparatus has been proposed for the purpose by Prof. Babbage, in his admirable little volume on the Economy of Manufactures and Machinery; and although it must be confessed, that several of the schemes he has proposed in that work, remind us a little of the designs of the sages in Swift's College of Laputa, this is not one of them, but seems adapted to its proposed object.

" An earthquake," he remarks " is a phenomena of such frequent occurrence, and so interesting both from its fearful devastations, as well as from its connexion with geological theories, that it became important to possess an instrument which shall, if possible, indicate the direction of a shock, as well as its intensity. An observation made a few years since at Odessa, after an Earthquake which happened during the night, suggests a simple instrument by which the direction of the shock may be determined.

" A glass vase, partly filled with water stood on the table of a room in a house at Odessa; and from the coldness of the glass, the inner part of the vessel above the water was coated with dew. Several very perceptible shocks of an Earthquake happened between three and four o'clock in the morning; and when the observer got up, he remarked that the dew was brushed off at two opposite sides of the glass, by a wave which the Earthquake had caused in the water. The line joining the two highest points of this wave, was of course that in which the shock travelled. This circumstance which was accidentally noticed by an Engineer at Odessa,* suggests the plan of keeping, in countries subject to Earthquakes, glass vessels partly filled with treacle or some unctuous fluid, so that when any lateral motion is communicated to them from the earth, the adhesion of the liquid to the glass shall enable the observer, after some interval of time, to determine the direction of the shock.

" In order to obtain some measure of the vertical oscillation of the earth, a weight might be attached to a spiral spring, or a pendulum might be sustained in a horizontal position, and a sliding index be moved by either of them, so that the extreme deviations might be indicated by it. This, however, would not give even the comparative measure exactly, because a difference in the velocity of the rising or falling of the earth's surface would affect the instrument."

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* Memoires de l'Academie des Sciences de Petersburgh, 6me series, tome i. p. 4.

Were observers always to employ vessels of the same dimensions, as for instance hemispherical cups of earthern-ware, painted white interiorly, having a diameter of ten and a depth of five inches fixed on a standard a foot in height, and filled for two inches of their depth by a fluid as nearly as possible of the same tenacity as treacle, the observations made at different points would be comparable with each other, and it would perhaps be a simpler method of estimating the intensity of the shock, than either of those proposed by Professor Babbage, were a graduated semi-circular arc to be fitted inside the cup, and the difference between the highest and lowest points of the wave caused by the shock, to be observed from it. This difference would be in a certain degree proportional to the intensity, being greater, as it was greater and less as it was less; and although it would after all be but a rough approximation, still it would be interesting, and worthy of remrak.

The discussion of all local observations ought to be undertaken by one person, who by combining them properly, would be able to deduce general results of the highest interest. It may be long ere we can find any means of protection against the appalling, and apparently irresistible effects of such convulsion as Earthquakes, but if observation confirms the idea of their connection with a certain geological structure of country, we shall at least be able to point out where danger is to be peculiarly apprehended, and by avoiding such localities, diminish the fearful records of death and suffering, by which the occurrence of Earthquakes has hitherto been accompanied.

It will afford the writer the highest satisfaction to be furnished with detailed accounts of Earthquake shocks, in whatever part of India they may occur; and in any cases in which the expence of Postage may be a consideration to observers, he begs they will have no hesitation in forwarding their remarks to him "bearing."* The subject is one of deep interest and importance, and the co-operation of observers in all parts of the country is earnestly solicited, since it is only by wide-spread observations that justice can be done to the subject, and such observations it is quite impossible for any single individual to collect satisfactorily.

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* Communications on the subject of Earthquakes may be addressed to the author at Saharunpore, Upper India, or if preferred, he has no doubt the pages of this Journal will be cheerfully opened to them.

Most unquestionably. Any number of copies of any such paper will be printed and stitched as a pamphlet for (gratis) distribution, and distributed as required, or sent to the author.

Saharanpore, 5th April, 1842.

Notice of the predatory and sanguivorous habits of the Bats of the genus Megaderma, with some Remarks on the blood-sucking propensities of other Vespertilionidæ. By EDWARD BLYTH, *Curator to the Asiatic Society.*

Chancing, one evening, to observe a rather large Bat enter an out-house, from which there was no other egress than by the door-way, I was fortunate in being able to procure a light, and thus to proceed to the capture of the animal. Upon finding itself pursued, it took three or four turns round the apartment, when down dropped what at the moment I supposed to be its young, and which I deposited in my handkerchief. After a somewhat tedious chase, I then secured the object of my pursuit, which proved to be a fine pregnant female of *Megaderma lyra.* I then looked to the other Bat which I had picked up, and to my considerable surprise, found it to be a small *Vespertilio,* nearly allied to the European *V. pipistrellus,* which is exceedingly abundant not only here, but apparently throughout India, being the same, also, to all appearance, as a small species which my friend Dr. Cantor procured in Chusan: the individual now referred to was feeble from loss of blood, which it was evident the *Megaderma* had been sucking from a large and still bleeding wound under and behind the ear; and the very obviously suctorial form of the mouth of the *Vampyre* was of itself sufficient to hint the strong probability of such being the case. During the very short time that elapsed before I entered the out-house, it did not appear that the depredator had once alighted; but I am satisfied that it sucked the vital current from its victim as it flew, having probably seized it on the wing, and that it was seeking a quiet nook where it might devour the body at leisure. I kept both animals wrapped separately in my handkerchief till the next morning, when procuring a convenient cage, I first put in the *Megaderma,* and after observing it some time, I placed the other Bat with it. No sooner was the latter perceived, than the other fastened on it with the ferocity of a Tiger, again seizing it behind the ear, and made several efforts to fly off with it, but finding that it must needs stay within the precincts of the cage, it soon hung by the hind-legs to one side of its prison, and after sucking its victim till no more blood was left, commenced devouring it, and soon left nothing but the head and some portions of the limbs. The voidings observed very shortly afterwards in its cage resembled clotted blood, which will explain the statement of Steedman and others concerning masses of congealed blood being always observed near a patient who has been attacked by a South American *Vampyre*.

Such, then, is the mode of subsistence of the Megaderms. The sanguivorous propensities of certain Bats inhabiting South America have long been notorious, but the fact has not heretofore been observed of any in the old world*; and the circumstance of one kind of Bat preying upon another is altogether new, though I think it not improbable that the same will be found to obtain (to a greater or less extent) among the larger species, if not throughout the whole extensive allied genus of *Rhinolophus*, (or the horse-shoe Bats,) which, like *Megaderma*, are peculiar to the Eastern world.

It may appear strange, that with the multitudinous attestations ascribing blood-sucking habits to certain Bats of South America, naturalists have been found unwilling to credit the statement, as instanced by Mr. W. S. McLeay, who, in a note appended to the remark that a particular species of butterfly, inhabiting Cuba, is much preyed upon towards the evening by different species of Bats, adds " principally the *Phillostoma Jamaicense* [*Arctibeus Jamaicensis,* Leach]. By the way," remarks this observer, " in the 2d edition of the *Règne Animal*, the author says of the Phillostomes, ' Ce sont des animaux d'Amerique. qui ont l'habitude de sucer le sang des animaux ;' I can only say that this is not only quite untrue as respects the Cuban species, but perfectly impossible [!]. The *Ph. Jamaicense*, for instance, lives on fruits and winged insects, in search of which latter it will be found in bed rooms. The *Vampyre* Bat of South America is also a *Phyllostoma* of Cuvier and Geoffroy ; but until some person having pretension to the name of naturalist shall establish the fact on personal observation, I shall as readily believe that it sucks the blood of men as that the *Caprimulgus* sucks the milk of goats."—*Trans. Zool. Soc.*, I, 187.

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* There are, it is true, certain vague statements, but quite unworthy of credit, ascribing sanguivorous habits to the *Pteropodes*. Thus De Vaux, in his 'Letters from the Mauritius,' (p. 65), describes these animals to "feed indiscriminately on fruit, small warm-blooded animals, and insects, as well as to suck the blood of men and cattle" But were this the case, the fact would assuredly be well known in India, where "Flying Foxes," as they are termed, are so very abundant. Of one brought alive into France, it is indeed stated, that "during the voyage, on one occasion when its food ran short, it fastened upon a dead fowl, and made a meal of part of it; and from that time animal food was occasionally given to it:" but I doubt much whether this was a natural appetite of the creature, from observation of one exhibited in England by Mr. Cross, of the Surrey Zoological Gardens, and *puffed* by him in advertisements and hand-bills as the wondrous "*Vampyre*." This animal would eat nothing but fruit and vegetables, and constantly refused insects, a variety of which I offered to it. It was tame, and appeared fond of being noticed. Hence I am also inclined to doubt a statement which I have somewhere met with, to the effect that the little Kiodote is partly insectivorous, this animal being known with certainty to feed largely on the fruit of the *Eugeniæ*.

This is rather a sweeping denunciation of the detailed assertions of Condamine, Steedman, and a host of others, though there is now every reason to conclude that Mr. McLeay is perfectly correct, so far at least as regards the *Phyllostomata* attacking large animals ; and concerning this genus, too, he mentions a fact which is not generally known, stating that its members are partly frugivorous. The same is, however, also noticed by Mr. Swainson, who informs us, (*Class. Quadrupeds*, p. 94,) that " several of the Brazilian Bats are likewise frugivorous, and to such a degree, that we remember never having been able to secure a ripe fig from a garden we possessed at Pernambuco, and where many of these trees grew : nets, indeed, were spread over them, but the cunning animals seemed to have the instinct of mice ; they crept under the smallest opening, and completely baffled our endeavours to stop their plunderings." But this author also notices the sanguivorous habits of at least some South American species, mentioning that, " Our horses and mules, after having arrived at the end of a day's journey, and been turned out to graze, would be brought in by the guides in the morning with their shoulders covered with blood."

To be brief, in all instances wherein the habits of the *Phillostomata* have been directly observed, the result has corresponded with the above statements. Mr. Waterton, for example, tells us, in his celebrated ' Wanderings,' " As there was a free entrance and exit to the *Vampyre* in the loft where I slept, I had many a fine opportunity of paying attention to this nocturnal surgeon. He does not always live on blood. When the moon shone bright, and the fruit of the banana was ripe, I could see him approach and eat it. He would also bring into the loft, from the forest, a green round fruit, something like the wild guava, and about the size of a nutmeg. There was something, also, in the blossom of the suwarrè nut tree, which was grateful to him; for on coming up a creek, on a moonlight night, I saw several Vampyres fluttering round the top of the suwarrè trees, and every now and then the blossoms, which they had broken off, fell into the water. They certainly did not drop off naturally, for on examining several of them, they appeared quite fresh and blooming. So I concluded the Vampyres picked them from the tree, either to get at the incipient fruit, or to catch the insects which often take up their abode in flowers.

"There are," according to Mr. Waterton, "two species of Vampyre in Guiara, a larger and a smaller. The larger sucks men and other [mammiferous] animals; while the smaller seems to confine itself chiefly to birds. I learned from a gentleman, high up the river Demarara, that he was completely unsuccessful with his fowls, on account of the small Vampyre. He shewed me some that had been sucked the night before, and they were scarcely able to walk." He then proceeds to give a humorous account of his companion, a North Briton, who had been bitten by one of these creatures, and lay muttering imprecations on the whole race of them. "As soon as there was light enough," writes Mr. Waterton, "I went to his hammock, and saw it much stained with blood. 'There,' said he, thrusting his foot out of the hammock, 'see how these infernal imps have been drawing my life's blood.' On examining his foot, I found that the Vampyre had tapped his great toe: there was a wound somewhat less than that made by a leech; the blood was still oozing from it. I conjectured he might have lost from 10 to 12 oz. of blood.

"I had often wished," continues this observer, "to have been once stung by the Vampyre, in order that I might have it in my power to say it had really happened to me. There can be no pain in the operation, for the patient is always asleep when the Vampyre is sucking him, and as for the loss of a few ounces of blood, that would be a trifle in the long run. Many a night have I slept with my foot out of the hammock, to tempt this winged surgeon, expecting that he would be there; but it was all in vain; the Vampyre never sucked me, and I could never account for his not doing so, for we were inhabitants of the same loft for months together."—(pp. 174—9).

The very obvious inference is, that the large *Phyllostomata*, which Mr. Waterton, in common with Steedman and the mass of other narrators of the doings of the Vampyre, have accused of this blood-sucking propensity, are totally innocent of the charge, as regards at least their attacking human beings or other large animals; but that there does exist a true Vampyre, capable of inflicting wounds such as described, which most assuredly the formidable canines of the *Phillostomata* are quite unfitted for, is equally evident from the above cited testimony alone. According to Condamine, "The Bats, which suck the blood of horses, mules, and even men, when they do not secure themselves from them by sleeping under a tent, are a nuisance, common to most of the hot countries of America, and some of them are of a monstrous bigness [?]: at Borja, and in divers other places, they have entirely destroyed the great cattle, which the Missionaries had introduced, and which had begun to multiply in those parts." In corroboration of this account, an accomplished modern traveller, Mr. Schomburgh, has assured me, that at Wicki, on the river Berbice, no fowls could be kept on account of the ravages of these creatures, which attacked their combs, causing these to appear white from loss of blood. Goats resisted them best, but even hogs were attacked by them.

In the report of the Committee of the French Academy, upon the results of M. Alcide d'Orbigny's late expedition, published in the 'Nouvelles Annales du Museum,' III, 90, we are informed, that "Dans l'ordre des Carnassiers, M. d'Orbigny a surtout étudié les *Vampyres*, dont il a pu confirmer les habitudes de sucer le sang des animaux, et même de l'homme, et cela sur ces gens et sur les mulets de sa caravanne. L'avidité de ces animaux pour le sang est telle, que les naturels sont obligèes pour y soustraire de passer la nuit dans des moustiquaires, et de renfermer soigneusement leurs poules et autre animaux domestiques. Le Vampyre choisit, en géneral, la nuque, le cou, ou le dos de la victime, afin qu'elle puisse plus difficilement s'en d'ebarasser; auqu'elle fait cepandant en se roulant sur le dos."

Thus far we have still no satisfactory information as to what is the real depredator, for not only is there strong presumptive evidence that this cannot be the *Phillostoma*, as currently supposed, but the real habits of this group, so far as positively observed, would appear to be solely frugivorous and insectivorous. To Mr. Charles Darwin we owe the solution of this mystery. " The *Vampyre*", writes this accomplished naturalist, " is often the cause of much trouble, by biting the horses on the withers. The injury is generally not so much owing to the loss of blood as to the inflammation which the pressure of the saddle afterwards produces. The whole circumstance has lately been doubted in England, and I was therefore fortunate in being present when one was caught on a horse's back. We were bivouacking late one evening near Coquimbo, in Chili, when my servant, noticing that one of the horses was very restive, went to see what was the matter, and fancying he could distinguish something, suddenly put his hand on the beast's withers, and secured the Vampyre. In the morning the spot, where the bite had been inflicted, was easily distinguished from being slightly swollen and bloody. The third day afterwards we rode the horse without any ill effect.

" Before the introduction of the domesticated quadrupeds," continues Mr. Darwin, "the Vampyre Bat probably preyed on the Guanaco, or Vicugna, for these, together with the Puma, and Man, were the only terrestrial mammalia of large size, which formerly inhabited the northern parts of Chili. This species must be unknown, or very rare, in Central Chili, since Molina, who lived in that part, says that no blood-sucking species is found in that province."

The specimen here referred to, is now deposited in the Museum of the Zoological Society, and is referrible to the genus *Desmodus* of Prince Maximilian of Saxe Nieud, or *Edostoma* of d'Orbigny, differing very widely in its dental characters from *Phillostoma,* or indeed any other animal previously known. Its entire structure is expressly modified for the *Vampyre's* mode of subsistence. It has only two upper incisors, corresponding to the ordinary middle pair of the *Primates* generally, and which, ordinarily larger than the others, here attain their maximum of development to the exclusion of the latter: they are large, and of singular form, approximated, and occupy the whole space between the canines, are longitudinally bent abruptly inward near the median line, and prolonged and acutely pointed at the tip of the bend, being received into a cavity or sheath behind the lower incisors when the mouth is closed, the under-jaw consequently projecting beyond the upper: together with analogousl ancet-shaped canines, which are thinly compressed laterally; they form an admirable instrument for blood-letting, inflicting a triple puncture like that of a leech: the lower canines are small and not compressed, and there are four bilobate inferior incisors, the medial separated by a wide interval. Instead of the sharply tuberculated molars of the Phyllostomes, and of that division in particular styled *Vampyrus* by systematists, there are even no true molars whatever, intimating that the accustomed food requires no mastication; but there are two false molars immediately behind the canine in the upper-jaw, and three antagonizing with them in the lower, that present only keenly cutting edges, adapted for severing in the manner of a pair of scissors. Nor is this all:—as in carnivorous animals, wherein the food is more readily assimilated, the intestines are consequently less prolonged than in vegetable-feeders, so in the present most remarkable genus, where blood—warm from the living veins, and even quickened by the vital principle,—constitutes the aliment, the intestines (as I have been informed) proceed almost straight to the anus. In short, we have here an animal duly organized for the mode of life so often described, which the *Phillostomata* are not; and there can scarcely be a doubt that numerous species of *Desmodus* exist in tropical America, being everywhere the veritable *Vampyres* which attack man and other large animals, as a general rule during their sleep, and inflicting wounds so gently with their keenly pointed and lancet-like instruments of incision, that no sense of pain follows to awake their victim. Nevertheless, admitting the great probability of this, there still remain some matters for further explanation, to which my discovery of the predatory habits of the *Megaderma* seems to afford a key.

Among the South American *Vespertilionidæ* having teeth of the ordinary conformation, Professor Bell describes the tongue of the *Phyllostomata* to have "a number of wart-like elevations, so arranged as to form a complete circular suctorial disc, when they are brought into contact at their sides, which is done by means of a set of muscular fibres, having a tendon attached to each of these warts."* Now, for what purpose can this be? For drawing forth the juices of fruits? I suspect not: and Spix, it may be remarked, expressly designates his *Glossophaga amplexicaudata*, (which, however, presents another modification of the tongue, this being slender and elongate, and furnished with hair-like papillæ,) *Sanguisuga crudelissima*, a very cruel bloodsucker; an expression which would seem to imply habits analogous to those of the Megaderms; for these bite away at their victim in savage earnest, while drawing the life-blood from its veins. In short, there are two classes of blood-sucking Bats,—one gentle and insidious, which attack any large animal during its sleep, are expressly organized for this purpose, and doubtless derive their whole sustenance in this way,—and another openly rapacious, which ferociously attack (it may be presumed) any small warm-blooded creature that they can master, and more especially, it is probable, prey on the smaller and weaker members of their own tribe, first drawing their blood, and then devouring them, as instanced by the oriental Megaderms; and to this latter class, I imagine, many of the large leaf-nosed Bats of South America appertain (though also known to feed both on fruit and insects), and probably also at least the larger *Rhinolophi.**

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* Dr. Todd's *Cycl. Anat.* and *Phys.*, Art. *Cheiroptera*

With regard to the *Megaderma lyra,* I am of opinion (founded on further observation of the captive animal), that it is in no degree whatever frugivorous, and the structure of its mouth would imply that it is no insect-hunter; neither do I think it evinces any disposition to attack small birds, either at roost or moving: but I am led to infer that the smaller *Vespertilionidæ* constitute its main, if not sole, subsistence, and suspect that these are seized while on the wing, and carried off to be devoured at leisure in some quiet recess, the preyer meanwhile sucking the vital fluid from the neck of its victim. There is more energy about it than I have observed in any other kind of Bat, at least during the day: go when you will, it is always lively and on the alert; and the expression of its physiognomy is far from dull, having comparatively large eyes for a Bat, which are bright and prominent. The species does not appear to be rare about Calcutta.

I may further remark, that the inguinal teats are well developed in this genus, as in the *Rhinolophi;* equally so, indeed, with the pectoral teats, insomuch that no one who examined them could suppose that they are mere sebaceous glands, as suggested by Prof. Bell in the case of the *Rhinolophi.* This fact is not uninteresting with relation to the described position of the teats in the genus *Cheiromys.*

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* The tongue of the Megaderms presents nothing remarkable in its conformation; but the lips are, in this instance, expressly modified for suction, which is not the case in *Phyllostoma.* It is not unlikely that the West Indian genus *Mormoops*, of Leach, is another raptorial form.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—October 1840.

Day.	Morning Tide A. M. Low Water. Time.	Morning Tide A. M. Low Water. Height.	Morning Tide A. M. High Water. Time.	Morning Tide A. M. High Water. Height.	Morning Tide A. M. Range of Tide.	Wind.	Evening Tide P. M. Low Water. Time.	Evening Tide P. M. Low Water. Height.	Evening Tide P. M. High Water. Time.	Evening Tide P. M. High Water. Height.	Evening Tide P. M. Range of Tide.	Wind.	Weather, &c.
1 Thursdy.	7 49	4 3	1 24	9 11	5 8	S. E. ..	8 3	2 1	1 56	10 9	8 8	South...	6. A. M. rather cloudy, 8 A. M. clear.
2 ,,	8 7	4 8	2 14	9 4	4 8	S.	8 12	2 6	2 15	10 4	7 10	S S.W.	8 43 A. M. thunder, day alternately clear and cloudy, 9 30 P. M. cloudy with appearance of rain.
3 ☽	8 16	5 1	2 25	9 6	4 5	S.S.W.	8 37	3 11	2 34	10 2	6 3	S. W...	4 20 A. M. squall from S. W., 4 38 light shower, day alternately clear and cloudy.
4 Sunday,	8 49	5 4	2 48	9 3	3 11	S. W...	9 2	5 11	3 2	9 11	4 0	S.S.W.	4 20 A. M. Do. do. 4 47 heavy showers with thunder and lightning, forenoon cloudy with light rain, noon clear.
5 ,,	9 6	6 2	3 12	9 1	2 11	S.S.W.	9 13	6 4	3 25	9 4	3 0	S. W...	——— day alternately clear and cloudy.
6 ,,	9 49	6 9	3 48	8 9	2 0	S. W...	11 12	6 7	4 19	8 11	2 4	Calm. ..	4 23 A. M. squall with rain, thunder, and lightning, 11 13 passing showers, noon overcast.
7 ,,	0 0	0 0	5 43	9 2	0 0	West. ..	0 17	7 3	6 49	9 8	2 5	S.S.W.	2 15 A. M. heavy showers with thunder and lightning, day alternately clear and cloudy.
8 ,,	1 12	7 4	7 46	9 9	2 5	S. W...	1 53	6 7	8 36	9 11	3 4	S. W...	1 45 A. M. squall with rain, thunder, and lightning, day do. do., 8 43 P. M. thunder and lightning.
9 ,,	2 14	5 6	9 15	10 1	4 7	S. W...	2 43	5 2	9 27	11 2	6 0	N.	——— day alternately clear and cloudy.
10 ,,	3 0	4 11	10 4	10 10	5 11	S. W...	3 32	4 7	10 46	11 6	6 11	S. S. W.	Forenoon clear, noon sultry, 2 37 P. M. squall from SSW. with thunder, evening clear.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—October 1840,—*(Continued.)*

Day.	Morning Tide A. M.						Evening Tide. P. M.						Weather, &c.
	Low Water.		High Water.		Range of Tide.	Wind.	Low Water.		High Water.		Range of Tide.	Wind.	
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
11○ Sunday	4 43	3 9	11 12	11 4	7 7	S. W...	5 18	4 5	11 32	11 8	7 3	S.	Forenoon clear, and sultry all day, 11-56 A. M. thunder.
12 ,,	5 33	2 11	11 23	11 6	8 7	S. S.W.	5 48	2 7	11 47	11 9	9 2	S. W...	Forenoon clear, noon cloudy, afternoon alternately clear and cloudy.
13 ,,	6 3	3 9	0 0	0 0	0 0	S. W...	6 9	2 1	0 10	11 8	9 7	S. W...	Clear all day.
14 ,,	6 18	3 2	0 17	11 2	8 0	S. E. ..	6 32	2 3	0 32	11 7	9 4	S. W...	Day alternately clear and cloudy, 2. 48 P. M. thunder, 7 lightning. 6 A. M hazy, 11 30 A. M. thunder, 11 49 squally, noon light rain.
15 ,,	6 47	3 11	0 53	10 11	7 0	S. E. ..	6 57	2 5	0 49	12 3	9 10	S. W...	
16 ,,	7 2	4 6	1 9	10 9	6 3	Calm. ..	7 12	2 11	1 15	11 7	8 8	S. W...	Forenoon clear, noon cloudy, 1 34 P. M. squally, 2 P. M. drizzling rain, 6 52 thunder.
17 ,,	7 20	5 4	1 22	10 6	5 2	S. E...	7 54	4 10	1 49	11 2	6 4	S.	Forenoon clear, noon cloudy, 35 P. M. thunder, 5 46 P. M. drizzling rain, 6 52 thunder.
18☾ Sunday	8 17	5 6	2 23	10 1	4 7	S. W. ..	8 49	5 1	2 37	10 11	5 10	S. S. W.	6 55 A. M. light rain, 8 25 thunder, day cloudy throughout.
19 ,,	9 23	5 4	3 13	9 10	4 6	North.	10 27	6 1	3 38	9 9	3 8	W.	2 48 A. M. thunder, 10 25 light rain, noon cloudy, afternoon rather clear.
20 ,,	10 46	6 2	5 19	0 0	3 8	North.	11 42	6 4	5 56	9 8	3 4	S. W...	7 A. M. thunder, 8 54 showers, day cloudy throughout.
21 ,,	0 0	0 0	6 27	9 11	0 0	N. E...	2 18	6 3	8 17	10 3	4 0	S. W...	Day alternately clear and cloudy, 1 10 P. M. thunder.
22 ,,	2 38	5 10	8 49	10 2	4 4	N. W.	2 43	5 3	9 27	10 9	5 6	S. W...	Ditto do. do., 2 4 P. M. thunder and lightning.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—October, 1840,—*(Continued.)*

Day	Morning Tide A. M.						Evening Tide P. M.						
	Low Water.		High Water.		Range of Tide.	Wind.	Low Water.		High Water.		Range of Tide.	Wind.	Weather, &c.
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
23 ,,	3 7	5 6	9 39	10 7	5 1	N.	3 18	4 5	10 5	11 2	6 9	N. W...	7 A. M. thunder, day alternately clear and cloudy, 11 43 A. M. passing shower, 2 3 P. M. thunder.
24 ,,	3 34	5 2	10 23	10 10	5 8	N.	4 13	3 11	10 48	11 4	7 5	N.	Clear all day, 1 57 P. M. thunder and lightning, 2 48 light rain.
25 ● Sunday	4 18	4 10	11 8	11 1	6 3	W. .	4 27	3 2	11 38	11 5	8 3	E.	Forenoon clear, afternoon cloudy, 3 57 P. M. thunder and lightning, 4 12 rain.
26 ,,	4 39	5 3	11 34	11 6	6 3	W. ..	4 52	2 11	11 58	11 4	8 5	N.	9 43 A. M. light rain, noon cloudy, 7 30 P. M. drizzling rain.
27 ,,	5 3	5 1	0 0	0 0	0 0	W.	5 10	2 3	0 6	10 11	8 8	W.	——— cloudy all day, 3 8 P. M. thunder, 3 25 rain.
28 ,,	5 18	5 7	0 17	10 9	5 2	W.	5 32	2 1	0 23	11 1	9 0	South...	Ditto ditto 7 9 P. M. light rain until midnight.
29 ,,	5 45	5 8	0 38	10 2	5 6	N. W...	5 58	1 11	0 58	11 3	9 4	S. W...	Ditto ditto, 10 52 A. M. light rain.
30 ,,	6 2	5 10	1 7	10 1	4 3	N. W...	6 7	2 3	1 8	10 11	8 8	S. W...	2 23 A. M. heavy showers, 0 45 P. M. thunder, day alternately clear and cloudy.
31 ,,	6 12	5 7	1 13	9 11	4 4	N. W...	6 23	4 7	1 20	10 10	6 3	South...	Forenoon alternately clear and cloudy, noon dark and cloudy with thunder, 1 55 P. M. rain.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—November 1840.

Day.	Morning Tide A. M.						Evening Tide P. M.						Weather, &c
	Low Water.		High Water.		Range of Tide.	Wind	Low Water.		High Water.		Range of Tide.	Wind.	
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
1 Sunday.	6 29	5 2	1 28	9 6	4 4	W.	6 57	5 4	1 34	10 7	5 3	S. ...	4 25 A. M. thunder, 35 P. M. thunder, 2 15 showers, day alternately clear and cloudy.
2 ☽	7 8	5 7	2 7	9 3	3 8	N. W...	7 28	5 9	2 13	9 11	4 2	N.	6 47 A. M. light rain, 15 P. M. drizzling rain with thunder.
3 ,,	7 56	6 2	2 37	9 3	3 1	N.	8 53	5 11	2 17	9 2	3 3	S.	1 34 A. M. thunder, 1 47 passing showers, day alternately clear and cloudy.
4 ,,	9 8	6 3	3 12	8 9	2 6	N	10 53	6 7	3 52	8 7	2 0	S.	Day alternately clear and cloudy.
5 ,,	11 54	5 8	6 15	8 8	3 0	N.	0 0	0 0	6 16.	9 3	0 0	S. W...	Ditto ditto, 3 20 P. M. light rain with thunder.
6 ,,	0 49	6 2	7 57	9 7	3 5	N.	1 45	5 3	8 48	9 10	4 7	N. E...	Cloudy all day, 2 18 P. M. thunder with appearance of rain.
7 ,,	2 12	5 6	9 18	10 1	4 7	N. ...	2 22	4 7	9 34	10 4	5 9	N. E...	Forenoon clear, noon overcast, 2. 24 P. M. heavy showers, 9 24 light showers.
8 Sunday,	2 32	5 2	9 47	10 7	5 5	S.	2 43	4 2	9 56	10 9	6 7	N. W ..	Day alternately clear and cloudy, 2 10 M. P. drizzling rain.
9 ○	2 57	3 11	10 5	10 11	7 0	S. ...	3 19	3 1	10 29	11 2	8 1	N. W..	5 27 A. M. squall from westward with rain, day alternately clear and cloudy.
10	3 28	3 7	10 35	11 5	7 10	S. W...	3 39	2 3	10 49	11 4	9 1	N. W..	5 27 A. M. light rain, day overcast.
11 ,,	3 52	4 5	11 13	11 6	7 1	S.	4 17	1 11	11 23	11 5	9 6	N.	4 56 A. M. squall from westward with rain, day alternately clear and cloudy.
12 ,,	4 20	4 7	11 37	11 8	7 -1	W.	4 48	2 3	11 54	11 2	8 11	S.	2 37 A. M. ditto ditto ditto ditto ditto.
13 ,,	5 47	4 8	0 0	0 0	0 0	Calm.	6 18	2 3	0 17	11 6	9 3	Calm.	11 28 A. M. A passing shower, day alternately clear and cloudy, 1 30 P. M. thunder.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—November 1840,—*(Continued.)*

Day.	Morning Tide A. M.					Winds	Evening Tide P. M.					Wind.	Weather, &c.
	Low Water.		High Water.		Range of Tide.		Low Water.		High Water.		Range of Tide.		
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
14 ,,	6 49	4 11	0 28	10 11	6 0	N.	7 19	2 4	1 7	11 3	8 11	W	4 53 A. M rain, 5 10 squall from westward, 25 P. M. rain, day cloudy throughout, 6 50 P. M. light rain.
15 Sunday.	7 49	5 2	1 27	10 8	5 6	N. W.	8 5	3 2	1 52	11 1	7 11	W.	Day alternately clear and cloudy, 5 54 P. M. light rain.
16	8 19	5 3	2 12	10 3	5 0	N. E...	9 8	3 5	2 35	10 6	7 1	S.......	Ditto ditto, 8 5 P. M. ditto.
17	9 17	5 8	3 12	10 1	4 5	N. ...	10 53	5 3	3 24	9 3	4 0	W.	Ditto ditto, strong westerly wind prevailing, 5 56 P. M. squall from northward with rain.
18 ,,	11 56	5 11	5 57	9 5	3 6	N.	0 0	0 0	6 47	9 4	0 0	W.	7 12 A. M. drizzling rain, 1 15 P. M. thunder, 1 43 rain, 7 32 showers, 7 45 thunder.
19 ,,	0 53	5 6	7 12	9 6	4 0	N.	1 12	6 2	7 32	9 8	3 6	W.	8 19 A. M. ditto ditto, noon rather clear, 3 5 P. M. showers.
20 ,,	1 32	5 9	7 54	9 11	4 2	N.	1 56	3 11	8 13	9 11	6 0	N. W.	11 33 A. M. drizzling rain, day overcast.
21 ,,	2 23	5 4	8 42	10 3	4 11	N.	2 49	3 5	9 13	10 2	6 9	N.	10 42 A. M. ditto ditto, 1 34 P. M. rain with thunder and lightning.
22 Sunday.	3 15	4 7	9 56	10 11	6 4	N.	3 47	2 11	10 12	10 9	7 10	N. E...	Forenoon alternately clear and cloudy, 0 34 P. M. heavy showers, 1 5 thunder, 6 42 light rain, 7 2 thunder.
23 ,,	4 14	4 5	10 20	11 2	6 9	N.	4 23	2 6	10 34	11 1	8 7	N.	6 52 A. M. light rain, noon cloudy, 3 32 P. M. rain.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—November 1840.—*(Continued.)*

Day.	Morning Tide A. M.					Winds.	Evening Tide P. M.					Winds.	Weather, &c.
	Low Water.		High Water.		Range of Tide.		Low Water.		High Water.		Range of Tide.		
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
24 ●	4 49	4 8	10 53	10 11	6 3	N. E ..	5 7	2 3	11 12	11 2	8 11	N.	10 2 A. M. light rain, noon cloudy, 3 28 P. M. rain.
25 ,,	5 13	4 3	11 18	10 10	6 7	N.	5 19	2 1	11 28	11 3	9 2	N.	7 34 A. M. light rain, day cloudy with light rain occasionally.
26 ,,	5 38	4 1	11 36	10 11	6 10	N. W.	5 42	2 6	11 58	11 4	8 10	N.	8 3 A. M. ditto ditto, noon cloudy, afternoon partially clear.
27 ,,	6 7	5 6	0 0	0 0	0 0	N.	6 17	2 9	0 13	10 11	8 2	N.	Day alternately clear and cloudy.
28 ,,	6 42	5 7	0 28	11 1	5 1	N. W.	6 58	3 1	0 53	10 9	7 8	S.......	Ditto ditto, 9 17 A. M. squall from southward with light rain.
29 Sunday	7 9	5 11	1 5	10 10	4 11	N.	7 18	3 4	1 20	10 6	7 2	S. W...	5 17 A. M. squall from westward, 5 32 heavy showers, day alternately clear and cloudy.
30 ,,	7 43	5 8	1 32	10 4	4 8	N.	8 6	3 8	1 56	10 4	6 8	S. W...	5 17 A. M. heavy showers, day alternately clear and cloudy.

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—December, 1840.

Day.	Morning Tide A. M.						Evening Tide P. M.						Weather, &c.
	Low Water.		High Water.		Range of Tide.	Wind.	Low Water.		High Water		Range of Tide.	Wind.	
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
1 Tuesday	8 11	5 9	2 12	9 11	4 2	N.	8 23	4 2	2 15	10 2	6 0	S. W...	Day alternately clear and cloudy, 1 32 P. M. thunder.
2 ☽	8 34	5 11	2 36	9 7	3 8	N.	8 53	4 4	2 47	9 6	5 2	S. by N.	11 27 A. M. showers, noon cloudy, 2 25 P.M. thunder.
3 ,,	9 12	6 2	3 6	9 7	3 5	N.	10 27	5 7	3 19	8 9	3 2	E.	2 18 A. M. a passing shower, 2 23 P. M. rain with thunder and lightning. Day alternately clear and cloudy.
4 ,,	10 49	5 9	4 45	8 7	2 10	E.	12 0	5 6	5 56	8 10	3 4	N.	6 A. M. clear, 11 42 light rain, noon thunder, afternoon overcast.
5 ,,	0 0	0 0	6 27	9 8	0 0	N.	0 25	4 9	6 57	9 10	5 1	N.	Day alternately clear and cloudy, 11 38 A. M. showers, 4 2 P. M. thunder.
6 Sunday	1 4	5 3	7 25	10 2	4 11	N.	1 26	4 2	7 49	10 1	5 11	N.	7 25 A. M. light rain, noon cloudy, 1 12 P. M. heavy showers, with thunder and lightning.
7 ,,	1 54	4 11	8 15	10 6	5 7	E.	2 7	3 2	8 36	10 3	7 1	N.	6 53 A. M. ditto, 2 26 P. M. do. do. do. do.
8 ,,	1 32	4 9	8 49	10 11	6 2	N. W.	2 49	2 7	9 16	10 8	8 1	N.	Day clear, 5 56 P.M. thunder & lightning.
9 ○	2 58	4 8	9 47	11 5	6 9	N. W.	3 25	2 4	9 43	11 3	8 11	N. W...	Day alternately clear and cloudy, 4 25 thunder and lightning, 4 55 rain.
10 ,,	3 52	4 3	10 23	11 10	7 7	N.	4 7	2 1	10 42	11 7	9 6	N. W...	Ditto ditto, 1 28 P. M. rain, 1 56 thunder and lightning.
11 ,,	4 59	3 11	11 19	11 11	8 0	N.	5 34	1 11	11 52	11 8	9 9	N. W...	Ditto do., 0 35 P. M. ditto, 3 30 rain.
12 ,,	5 54	4 11	0 0	0 0	0 0	S. W...	6 12	2 4	0 17	12 2	9 10	S. W...	5 25, A. M. light rain, 10 9 P. M. squall from westward with rain, &c.
13 Sunday	6 53	5 7	0 28	11 9	6 2	W.	7 9	2 11	1 9	11 11	9 0	S.......	Day alternately clear and cloudy, 7 8 P. M. squall with rain. [clear & cloudy.
14 ,,	7 27	5 2	1 27	11 5	6 3	N. W.	7 49	3 11	1 43	11 4	7 5	S. W...	,, 9 A. M. heavy showers, day alternately

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—December, 1840.—(Continued.)

Day.		Morning Tide A. M.										Evening Tide P. M.										
		Low Water.				High Water.						Low Water.				High Water.						
		Time.		Height.		Time.		Height.		Range of Tide.		Wind.	Time.		Height.		Time.		Height.		Range of Tide.		Wind.	Weather, &c.
15	,,	8	4	5	3	2	6	10	11	5	8	N. W...	8	29	6	1	2	23	10	6	4	5	S........	9 A. M. clear all day.
16	☾	8	49	5	6	2	45	10	3	4	9	N.	9	7	6	2	2	56	9	5	3	3	S. E. ..	—— day overcast.
17	,,	9	17	5	9	3	14	9	8	3	11	S. W...	10	17	6	3	3	38	9	3	3	0	S. W. ..	—— clear all day.
18	,,	10	53	5	9	4	28	9	6	3	9	N.	11	37	6	4	5	19	8	5	2	1	N.	10 37 A. M. showers, noon thunder, afternoon overcast.
19	,,	11	58	5	6	5	57	9	8	4	2	N.	0	0	0	0	6	15	8	4	0	0	S. W. ..	11 43 A. M. ditto, 30. P. M. ditto, day clear, and cloudy alternately.
20	,,	0	16	5	7	6	34	9	8	4	1	N. W...	0	47	5	4	7	24	8	9	3	5	N. W...	11 15 A. M. thunder 23 P. M. ditto do.
21	,,	1	12	5	7	7	37	10	2	4	7	N.	1	53	4	6	8	24	9	7	5	1	S. W. ..	10 42 A. M. rain, 2. 20 P. M. thunder do. do.
22	,,	2	11	5	4	8	32	10	7	5	3	S........	2	43	4	2	8	57	10	1	5	10	S. W. ..	6 2 A. M. rain, noon overcast 6 7 P. M. rain.
23	,,	2	57	5	2	9	5	10	4	5	2	N.	3	14	3	7	9	37	10	3	6	8	N.	Day cloudy throughout, 3 32 P. M. showers.
24	●	0	0	0	0	0	0	0	0	0	0	....	0	0	0	0	0	0	0	0	0	0	....	—— } No observation in consequence of the buoy of the tide-guage being worn out by friction.
25	,,	0	0	0	0	0	0	0	0	0	0	....	0	0	0	0	0	0	0	0	0	0	....	——
26	,,	0	0	0	0	0	0	0	0	0	0	....	0	0	0	0	0	0	0	0	0	0	....	——
27	Sunday	0	0	0	0	0	0	0	0	0	0	....	0	0	0	0	0	0	0	0	0	0	....	——
28	,,	0	0	0	0	0	0	0	0	0	0	....	7	57	3	2	0	0	0	0	0	0	N. E. ..	Day alternately clear and cloudy.
29	,,	8	11	4	11	2	11	10	2	5	3	N. E. ..	8	17	4	2	2	18	10	9	6	7	S. E. ..	Ditto ditto ditto, 11 45 A. M. light rain, 6 17 P. M. showers, 6 17 P. M. showers.
30	,,	8	28	5	6	2	27	9	11	4	5	N.	8	47	4	6	2	35	10	7	6	1	S. E. ..	Ditto ditto ditto, 1 15 P. M. light passing showers, 3 30 P. M. thunder with frequent showers.
31	,,	8	56	5	9	2	57	9	8	3	11	N.	9	7	4	9	3	12	10	6	5	7	E.	—— ditto ditto ditto, 1 37 P. M. rain.

(Signed,) Wm. SCOTT,
Asst. Master Attendant.

Proceedings of the Asiatic Society.

(*Friday Evening, 4th March,* 1842.)

The Hon'ble the President in the Chair.

The following Books were presented :—

Books received for the Meeting, on the 4th March, 1842.

The Calcutta Christian Observer, new series, vol. 3d, No. 27, March, 1842,	P
The Oriental Christian Spectator, 2d series, vol. 2d, No. 12th, Dec. 1841, and vol. 3rd, No. 1st, January 1842,	P
Yarrell's History of British Birds, part 27, London, October, 1841,	P
The Annals and Magazine of Natural History, vol. 7th, No. 47, and vol. 8th, No. 49, September and October, 1841, London,	P
London, Edinburgh, and Dublin Philosopical Magazine and Journal of Science, 3rd series, vol. 19th, Nos. 123-124, September, and October, 1841, London,	P
Memoir of the Royal Astronomical Society of London, 1840, vol. 11th,	1
Journal des Savants, Juin à Juillet, 1841, Paris,	2
Proceedings of the Geological Society of London, vol. 3rd, part 2nd, No. 76, 1841,	P
Sykes's Notes on the Religious, Moral, and Political State of India, London, 1841,	1
Sykes's Fishes of the Dukhun,	1
The Calcutta Literary Gleaner, vol. 1st, No. 1.	P
McCosh's Medical Advice to the Indian Stranger, London, 1841,	1

Three Volumes of Dewan and Masnevi, by Hakeem Rookeen-Uddeen of Kashaud, in good preservation, perfect, MSS. complete and well written, were offered for sale. Referred to the Committee of Papers.

The following letter from Mr. CSOMA DE KOROS was read. The account referred to, accompanied it:—

To H. TORRENS, ESQ.

Secretary to the Asiatic Society of Bengal, &c.

SIR,—Since I am about to leave Calcutta, for a certain period, to make a tour in Central Asia, if possible, I beg you will receive and keep this memorandum, after you have communicated it with the Asiatic Society.

I respectfully acknowledge, that I have received many benefits from the Asiatic Society, although I have declined always to accept the allowance of fifty rupees, which they generously granted me in 1829, 1831, and 1841; since the Government's allowance to me, during several years, was sufficient for my support.

I intend to return again to Calcutta, and to acquaint the Society with the results of my travels. But, in case of my death on my intended journey; since I sincerely wish the prosperity, and pray for the long continuance of this noble establishment, I beg to leave my Government Securities, as also the Books and other things now taken with me, at the disposal of the Asiatic Society, delivering herewith to you my last account of the 31st of January 1842, with the Government Agent, who is my attorney; and with whom the Promissory Notes are kept, and who will favour me, once a year, with the interest on those papers.

Since I purposely decline every correspondence with those in Europe, I beg you will kindly excuse me, if any letter or packet should be sent to me, do with it as you think best.

I remain with much respect,
Sir,
Your most obedient Servant,
A. Csoma De Koros.

Calcutta, 9th February, 1842.

The Secretary was requested to reply to Mr. Csoma, expressing the Society's willingness to accept the *Trusteeship* of his funds for his benefit, its earnest desire to forward his views in India in every possible way, and to render him any assistance; as well as its willingness to receive any further directions as to his funds; and its best wishes for his welfare and safe return from his enterprising expedition into Bootan and Tartary. It was also determined, that a copy of Mr. Csoma's letter should be transmitted to the Government Agent.

The following letter from Professor Wilson was also read:—

East India House, 30th October, 1841.

My dear Sir,—In a short letter I sent you by Mr. Coles, I informed you, that the copies of the Travels of Messrs. Moorcroft and Trebeck, which had been distributed here, were distributed in the name of the Society, and that any Societies not included in the list to which the Asiatic Society might wish to extend the presentation copies, might probably be supplied with them from those I had retained. They cannot be many. The book is not of much interest to Oriental scholars, and there are not many individuals or Societies in communication with the Asiatic Society engaged in other than Oriental literary inquiries. The chief purpose of my addressing you at present, however, is to ascertain the possibility of procuring subscriptions through the Society for a work I have just published. Ariana Antiqua, an account of the Coins and Antiquities of Afghanistan; it is a description in fact of Mr. Masson's Collections, and of some others at the India House. It is a goodly quarto volume of some 400 pages, and is intended to be a resumé of all that has been written on the Bactrian Topes and Coins. The text is illustrated by engravings of sundry Antiquities, of all the Topes opened by Mr. Masson, and of many hundred Coins from those of Euthydemus to those of the first Mahommedan invaders of India. The expence of the book has been liberally defrayed by the Court of Directors, who take part of the edition, out of which they will send a few copies to Bengal, from whence the Society will no doubt be supplied. The remaining portion, 300 copies, the Court has presented to Mr. Masson's mother, and it is for her benefit that the subscription is proposed. The price in England is 2 Guineas—allowing for expences, &c. the Indian subscription rate should be I imagine 25 Rupees. If you can procure any name from amongst those interested in Mr. Masson and his pursuits, and will send them to me with information how the subscription is to be realised, (or perhaps it would be advisable to deposit the amount with some agency house,) I will take care that all such copies as may be procurable shall be forwarded. Mr.

Lewis (Masson) has some of the copies subscribed for here, and expects some from Bombay, so that there will not be many left for Bengal.

Yours very truly,
H. H. Wilson.

ARIANA ANTIQUA,

Just published by Professor Wilson.

An account of the Coins and Antiquities of Affghanistan, being a description of Mr. Masson's Collections, and others at the India House, in one vol. quarto, pages about 400. The text illustrated by engravings of sundry Antiquities from all the Topes opened by Mr. Masson, and of many hundred Coins, from those of Euthydemus to the first Mahommedan invaders of India.

A few copies can be yet subscribed for in India, and the Secretary of the Asiatic Society will be glad to register names, with references for payment in India or England. Indian Subscription rate about 25 Rupees.

It was determined, that the work should be advertised in the Journal, and the Society should there state its readiness to become Agents for those who might desire to subscribe for it.

A second letter from Professor Wilson of 1st November 1841, referring to the incomplete numbers of volumes of the Mahabarat was read, and referred to the Librarian and Accountant to report upon.

The Annual Statement of the accounts of the Society's Booksellers, Messrs. W. H. Allen and Co. was also read, and with its enclosures referred to the Librarian and Accountant.

Read a note from J. W. Roberts, Esq. forwarding a highly interesting account of the eruption of the Volcano of Kilauca, (Sandwich Islands,) published in the Boston Baptist Missionary Magazine for August 1841.

Read a letter from Lieut. Tickell, Kolehan, to the Curator, advising the dispatch of the skins of a Gaur and a Saumer, prepared for the purpose of setting up in the Museum. A paper of measurement of the Gaur accompanied this letter, which will appear in the Journal.

The recovery of Capt. Herbert's valuable Catalogue of the Himalayan Geological Specimens, collected during his survey, was announced to the Society. These valuable MSS. which had been the objects of most anxious search on the part of the Secretary and the Acting Curator, Mr. Piddinton, and of which almost all hope had been abandoned, were fortunately traced, through the assistance of Mr. Wilkin, late Mining Assistant in Kemaon, to that district, where they were found to be in the hands of J. H. Batten, Esq. C. S. Assistant Commissioner, Kemaon, from whom a letter was read, stating, that they would be shortly sent down upon his return from a tour of duty in the district.

Read a letter of the 24th February last, from Major Thos. Wilkinson, Resident of Nagpore, announcing the dispatch from Nagpore of a facsimile of an Inscription, from a large stone found at the village of Aurung in Chutteesgurh, about 200 miles east of Nagpoor, to which place, however, the stone had been brought by him.

The Inscription has since been read; it is without date, but Boodhist, and of about A. D. 860. The following is an abstract of it :—

Abstract.

"There was a Raja named ***Surya Ghose,*** who on the sudden death of his infant son, being overwhelmed with grief, and conscious of the instability of the wordly pursuits, caused a magnificent building to be erected for the refuge of ***Moonees,*** (Ascetics). After a long series of years, he had another son, who was afterwards publicly known by the celebrated name of ***Udayana.***

"***Udayana*** had four sons, among whom ***Bhabadeva*** was the youngest. His son was ***Ranakesharé,*** who was the last Raja of that line. He repaired the palace of the ***Moonees,*** which had once been erected by his great-grandfather, and injured by time. Further, he caused many gardens, tanks, wells, and many charity houses to be made throughout."

Read a letter of Mr. STEFANO MORRICAND, Administrateur du Museé Académique à Geneve, addressed to the late Mr. BENSON, C. S. proposing to exchange specimens of Shells with him. This letter was transmitted to the Society by Dr. WISE, B. M. S.; but it was thought right that it should be referred in the first instance to Mr. BENSON's executors.

La Commission de la Bibliothym de la Ville de Berne, acknowledged the receipt of the 18th volume of the Society's Transactions through their President, M. CHAS. TEERLEDER.

Read a letter from G. A. BUSHBY, Esq. Secretary to Government, General Department, transmitting copy of a letter from the Military Board, with copy of one from Capt. TREMENHEERE, and a box containing specimens of Magnetic Iron Ore, Sulphuret of Antimony, and of Mergui Coal.

Read a letter from Lieut. H. K. SAYERS, S. P. H. M. 31st Regt. offering for the Journal of the Society, Recollections of a Visit to Madura, the capital of the Bullom Country, Western Africa.

For the Contributions and Presentations, thanks were accorded.

ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensgmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the remarkable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to the number at present only, we are able to estimate the riches of the whole creation, and to explain the alternations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°. with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

Herman von Meyer.

UTTERPARAH PUBLIC LIBRARY 1859

JOURNAL

OF THE

ASIATIC SOCIETY.

Notice of the Mammals of Tibet, with Descriptions and Plates of some new Species. By B. H. Hodgson, Esq., *Bengal Civil Service.*

Very little is known accurately of the Zoology of Tibet. Having lately received some valuable materials for its illustration from Digurchee and Lassa, I purpose, with the aid of these specimens, and of information procured orally and from books, to give a cursory notice of the subject.

CARNIVORA.

Felidæ.

1. Genus Felis, F. Uncia. Exactly answers Buffon's description, and is evidently the representative in high latitudes of the tropical Leopards. Equal in size to a Leopard of the largest dimensions, and distinguished not only by its long full pelage and very thick tail, thicker even than in Macrocelis, but also by its massive structure and for the comparative absence of compression in the talons, wherein there is a vague approach to Cynailurus. Length from snout to vent about four feet, and the tail a[illegible]¼ to 2½ feet. Never met with on this side the snows, and is said to be a cowardly unenterprising animal compared with the next species.*

2. Felis Macrocelis. Found on both sides of the snow in lofty Cisalpine sites as well as in Tibet; osculant in habitat, and in structure be-

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* There is a fine stuffed specimen of *Felis uncia* in the British Museum, procured, I believe, in the North of Persia, from which locality, Col. Hamilton Smith also saw a skin of this species, which he has represented in Griffith's Animal Kingdom, II, 469. I am not certain that the *F. irbis*, or long-haired Altaic Panther, of Humboldt and Ehrenberg is distinct from the Ounce, but have no description of the *Irbis* to refer to.—*Cur. As. Soc.*

tween the typical pards of the south and of the north; agrees with the last in its massive form, long full fur and thick tail, which last, however, is proportionally longer and hardly so thick. Macrŏcelis is further distinguished remarkably by the unusual length, slenderness, and insulation of the canines. In these hills, Europeans frequently confound it with the Leopards, thereby increasing the difficulty of deciding how many true pards there be, though its dull hue, and the more chain-like linear form of its marks ought at once to prevent such mistakes. In size too it is considerably less than the true Leopard; but its body has a length from snout to vent of about 3½ feet, and the tail is nearly 3 feet more. I have several skins procured in the Kachâr of Nepal, in Sikim, and from Digurchee in Tibet. The animal is most fierce and destructive among the flocks.*

3. Felis Lynchus, Lynchus Europœus vel Vulgaris. Answers exactly to the common type. Is never seen in India any where on this side of the Hemâchal, but is common in Tibet. Possess two skins from Lassa, one of which exhibits dimensions in excess of those usually ascribed to the species by authors. Snout to rump 38 inches, tail 9¼ inches.†

4. Felis Nepalensis, necnon Bengalensis. Possess one skin brought from beyond the snow, where however the species is rarer much than in the Cisalpine forests.

5. Felis Domesticus. The house Cat is common in Tibet. My collection exhibits from Lassa three skins, two black, and the third fawn and white one, with 9 to 10 caudal rings on the paler ground.

6. Felis Nigripectus, Mihi, new.‡ Size and general proportions of Catus, structure typical. Fur very rich and soft, consisting mostly of the inner woolly piles, the longer and hairy ones being scanter; average length of the latter 1½ inch, with some few hairs as much as 2½; average length of the former or inner fleece, 1¼ inch. General hue rufescent pale cat-grey, like Chaus, but paler and fading into rufescent hoary without any black tipt piles below and on the limbs: pads

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* That this fine species, originally discovered in Sumatra, should also inhabit Tibet, is a remarkable circumstance.—*Cur. As. Soc.*

† There are four distinct species of European Lynxes; and the dimensions above given would seem to refer this one to *F. cervaria:* but I will prepare a monograph of the group.—*Ibid.*

‡ Clearly the *F. manul* of Pallas, a description of which may be found in Shaw's Zoölogy, I, 362, and which Mr. Hodgson has thus the merit of further establishing, inasmuch as it has been regarded as a doubtful species.—*Ibid.*

postcally deep rusty: whole chest and front of neck and part of belly confluently sooty black, terminating forward near the ears hornwise or crescentwise: on the crown of the head several series of black dots disposed more or less linearly and lengthwise. On the cheeks from eyes to articulation of jaws two sub-parallel zigzag lines of jet black, five to seven straighter lines and less deep in hue laid transversly across the lower back, and blending gradually with the caudal rings, which are, including the small black tip of the tail, about nine in number. These rings of the tail are narrow, with large intervals diminishing towards its tip, as the interstices of the dorsal bars do towards the tail's base. The caudal rings are perfect all round, save the two basal ones that are deficient below, whilst the two apical ones, on the contrary, are rather wider below and nearly or quite connected there; rings and tip of the tail black outside the arms and thighs two or three transverse black bars more or less freckled with the grey hairs of the body. Ears outside grey like the back, but paler: Ears small and much rounded: tail medial, thick and cylindric: mystaceal and other bristles, some black, mostly rufescent hoary: outer fur or longer piles quadrannulate from the base with hoary, blackish, pale rufous and black; but on the lower surface of the animal these piles are biannulate only with dusky at base, and the rest rufescent hoary, except on the large pectoral dark mark, throughout which the shorter piles are wholly dark, and the longer the same, save at their mere bases: Inner fur, above or generally, slaty black towards the roots; pale rusty towards the tips. Sexes alike, female less in size: Length from snout to vent 22 to 24 inches, mean height 11 to 12, length of tail 10 to 11.

Remark.—Possess three specimens, the youngest shewing the marks most clearly, which in the others are grizzled with hoary; in one specimen the tail appears thin, and shews the rings very glaringly, owing to the outer or longer piles being wanting. Found in the wild state generally throughout Tibet, where all cat skins, tame and wild, are much prized for lining dresses, and the animals for food by the Chinese located there.*

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* There is a *Felis inconspicua*, Gray, suspected to be from Nipal, and described in *Mag. Nat. Hist.*, *N. S.*, I, 577. "Grizzle-grey, black and white, slightly varied with brownish streaks and waves; beneath white. Back of ears, large spots and cross-bands on the throat, belly, and outside of the legs, black. Two obscure streaks on the cheeks, yellowish, tail elongates cylindrical, grizzled, soles grizzled."

CANIDÆ.

7. Genus Canis. Tame dogs abound, and are much prized by the men for guarding the flocks and herds and houses, and by the women for petting. For the former purpose the Tibetan mastiff is used, of which there are several varieties, black, black and tan, or red with more or less of white. Some have the fifth toe behind. The breed at Lassa and Digurchee are the largest and best. They are good tempered, but dull and heavy, except on their night watch, and are utterly useless for sporting. Nor are any other breeds cultivated for sporting. The ladies dogs are Poodles and Terriers, many of which are pretty, and have long soft hair. The latter flourish in Nepal; the former cannot endure our heat. The Chinese at Lassa and Digurchee fatten the Poodles for the table.

8. Genus Cúón, C. Primævus. The wild dogs of the Cis-Himalayan regions are found also in Tibet, but rarely. I have four skins from Lassa, but they are all of very young animals. The breed of Tibet is large, and of a pale wolf-like colour.

9. Genus Vulpes, V. Montanus. Yet commoner in Tibet than on this side of the snows. I have 8 or 9 skins from Lassa, which offer no subject for remark.

10. Vulpes Ferrilatus, Mihi, new iron-grey sided Fox. Structure typical: size less than that of Montanus, but much larger than the ordinary Indian type. Possessed of the white tail-tip of the former, but not of its long and silky pelage. Fur very close, thick, porrect almost, harsher and shorter than in Montanus, very similar to that of Indicus vel Bengalensis. Inner fleece the more abundant, woolly and wavy as usual, and about one inch long; outer piles straight, elastic, and from 1¼ to 1½ inch in length: Brush full, of average length, with a pelage reaching to 2⅓ inches long. Colour, above and on the limbs bright rusty, laterally, and the tail iron-grey; below and tip of the tail, albescent-rufous: the lateral and inferior hues divided on the flanks by a rufous line and on the neck by a blackish one: Ears outside concolorous with the upper surface of the animal or rusty: a vague transverse black bar across the upper surface of the tail near its base: mystaceal and other bristles long, strong, and black. Sexes alike: females smaller. Snout to rump 26 inches: Tail with the hair, 12 to 13 inches. Inner fur unringed, and of the leading proximate external hue;

outer fur quadrannulate alternately with hoary and black; but on the ruddy black of the animal biannulate only, with blackish at the base and rusty at the tip.

Remark.—Possess four skins brought from Lassa; animal common in Eastern and Central Tibet, where also Montanus is yet more frequent. Fur prized by the furriers.

MUSTELIDÆ.

VIVERRINÆ.

11. Subgenus Viverra. V. Melanurus.

12. V. Civettoïdes. Possess skins of both these species, brought from the Himalayan districts, but on this side the central crests or spine of the snowy region.

13. Genus Paradoxurus, P. Nipalensis. I have one skin obtained at Kootee, but this and the last two belong properly to the Zoology of Nipal and India, not of Tibet.

14. P. Laniger. One skin from Tingree. Its purely woolly curled and thick fur indicates its northern locale on the verge of the habitat of the genus.

SUBGENUS MUSTELA.

15. M. Canigula, Mihi, new. Hoary-necked red Weasel; structure typical so far as appears. Fur or pelage thick, short, moderately applied, softly elastic, with an inner or woolly addition, and a somewhat longer and laxer display on the tail, which is rather more than half the length of the animal, slightly tapered and ends in the usual pointed prolongation of the terminal hair; colour, throughout cinnamon red, without black tip to the tail, but the chaffron and entire head and neck below hoary. Mystaceal bristles small, rigid, and of brown red hue; average length of the longer piles $\frac{11}{16}$ inch on the body, and on the tail one inch: average length of the shorter woolly piles $\frac{1}{2}$ inch: colour of the latter somewhat embrowned and dusky towards the base; but towards the tips, with the entire length of the longer piles, pure cinnamon-red, like the general external hue of the animal. Snout to rump $15\frac{1}{2}$ inches: head $2\frac{3}{4}$, tail only $7\frac{1}{2}$; tail and hair $9\frac{1}{2}$.

Remark.—Common in Tibet: rarer in the Himalayan region:* possess three specimens, the largest, above described, from Lassa. The young have the hoary colour much less developed, and the red hue duller. My specimens want the hind molars, so that I cannot positively assert whether the species belong to the subgenus Mustela, or to that of Martes, but I feel pretty sure to the former.*

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* M. Canigula is a new addition to the Mammalogy of Nepal; and Sorex Nemoricola is another, since my Catalogue was printed.

16. M. Erminea. Common in Tibet, where the skins enter largely into the peltry trade with China. Possess one specimen in the winter robe of the species, which is found also in the Himalaya, I hear.

17. M. Auriventer, vel Kathia. Found on the Tibetan as well as Indian slopes from the spine of the snowy region. Possess a skin from Tingree.

18. M. Sub-Hemachalanus. Since this species was first described, (*Journal*, July, 1837,) I have obtained several specimens from Tibet, as well as from the Himalayan districts, *cis et trans nivem.* The largest specimen is 15½ inches from snout to rump, head 2½, tail only 6. Tail and hair 7½. Planta 1¾. The smallest is 10½ inches long, and the tail 4 more, or 5 with the hair. The former is of a bright bay or brown red with labial edge ; whole chin and spot on middle of front neck, hoary. Bridge of nose and last third of tail, brown black. The latter is of a deeper and duller hue or smoky brown, with the lower jaw and lips albescent; and the nose and end of tail blackish as before.†

Remark.—All the above Musteline animals are much prized in Tibet for their skins, which the Chinese located there cure, and in Nepal, for their ability in killing vermin, though Auriventer be the species most commonly so used. None are ever found in Nipal, south of the Kachar, or northern region. The belly is never white in any of the species, but deep aureous in Auriventer and invariably so ; concolorous with the back in the rest. The pale hue under the head and neck extends with age. The fur is rather longer in Canigula, and the tail proportionally longer.

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* In typical *Martes* there is an additional false molar on each side of both jaws to what is ever found on *Mustela*, though the dental formula of the latter exists in a large Neilgheiry Marten, which Mr. Walter Elliot shewed to me at Madras, and of which the Zoological Society possess a specimen marked 308 *a*, in Mr. Waterhouse's printed Catalogue of the Society's Museum.—*Cur. As. Soc.*

† The Darjeeling *Mustela* described in my Report for January (*ante*, p. 98,) would seem to be referrible to this species, and I now think that the white mottling of the shoulders was merely the commencement of a general charge to white, as in the Ermine.—*Ibid.*

19. Mustela Calotis. The only specimen I have, is from the interior of Tibet. It has been recently described elsewhere.*

SUBGENUS MARTES.

20 Martes Flavigula. One specimen lately came to me from the Tibetan slopes of the Hemâchal, but the species is probably confined to the juxta Himalayan districts; for its natural habitat is the central region of Nepal, where it represents the true Mustelæ of the northern.

21. Martes (?) Toufœus, new, Mihi. Toufee of the peltry trade of the Chinese and Tibetans, who prize the skin very highly, next indeed to the sable. Have several fine skins from Lassa and Siling, but as they want the teeth and talons and tail, I can but conjecture from information and the specimens as they are, that the animal is a Marten. Thus judging, I should say, the Toufee has much of the size and proportions of the last or Flavigula; but its pelage is much richer and softer. In softness it equals the Vulpes Montanus, and is much fuller of fur or thicker; the longer piles being very glossy. Probable length from snout to vent 20 to 22 inches, mean height 7. Length of head about 4½; of auricle or free helix 1¼. Average length of the outer or hairy piles 1¾ inch, of the inner and woolly 1¼ inch. General colour smoky brown, darker along the spine and on the limbs, but without marks, and paled to sordid yellowish hoary on the neck and head: head palest except the mystaceal region and chin, which are embrowned: moustache moderate and dark brown. There are no rings on the outer or inner piles, which have both the general smoky brown hue of the exterior, only paler at the roots.

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* The *M. Sebirica* of Pallas, described in Shaw's 'Zoology,' I, 431, is another species which may perhaps turn up in Tibet.—I may also here notice a species which I believe to be now first distinguished from *M. putorius* viz. the Russian Pole-cat of the English furriers, which is quite a distinct species from that of Germany and Britain. I had an opportunity of comparing many very large bundles of skins of both animals at one of the Hudson's Bay Company's half-yearly exhibitions, those of genuine *putorius*, having been imported from Germany, and being quite undistinguishable from the animal of Britain. The Russian species is considerably smaller, not exceeding the Stoat or Ermine in size, with tail (vertebra) measuring 4½ inches or with its hair 6½ inches. Pelage nearly similar to that of the British Pitch or 'Pole-cat,' but apparently becoming nearly white in winter: and all the multitude of skins I saw had the pale ground-tent much whiter, and more predominating, than in the very numerous examples of *M. putorius* examined on the same occasion. This Russian species may be styled *M. putorinus*."—*Cur. As. Soc.*

22. Genus Lutra, L. Aurobrunnea. This and another small species of Otter are found in Tibet, but rarely, and the vast demand caused by the Tibetan and Chinese fancy for furs is supplied from Sylhet and Dacca chiefly, and in a less degree by these mountains, in the article of Otter skins.

URSINÆ.

GENUS URSUS.

23. Ursus Isabellinus. Fragments of a skin from the further and Tibetan slopes of the Hemâchal, none from the plain of Tibet, where there are said to be no Bears. The species never wanders south of the Kachar on this side the snows, and is represented in the central region of Nipal by Tibetanus, (a species unknown not only to Tibet, but to the Kachar of Nipal,) and in the southern by Labiatus.

ANAPTOTHERES.

24. Genus Sus, S. Scophra, tame. Pigs of the common Indian and also of one or two Chinese breeds are commonly kept and eaten in Tibet, except by the religionists. No wild ones exist there.*

Ruminantes Bovinæ.

GENUS BOS.

25. Subgenus Bison, B. Poephagus. Found in the wild as well as tame state in Tibet, where the tame ones abound, and are put to all uses. In Nepal they will not live south of the Kachar.†

26. Sub-genus Bos.—Bovines other than the Yak or last named, are rare in the tame state, and unknown in the wild. There are, however, three tame breeds of Cows, chiefly kept by the rich for their milk, whilst the poor Yak is the beast of burden, of agricultural labour, and of the beef market.

CAPRIDÆ.

GENUS PANTHOLOPS.

27. Pantholops Hodgsonii. Common all over the open plains of Central and Eastern Tibet: never passes nor nears the Hemâchal.

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* In the country of the Usbegs, Wild Hogs would appear to be very numerous. "Descending the eastern side of the Junas Durah," writes Lieut. Wood, "our march was rendered less fatiguing by following hog-tracks in the snow; so numerous are these animals, that they had trodden down the snow as if a large flock of sheep had been driven over it." *Journey to the Source of Oxus.—Cur. As. Soc.*

† Wild Yaks exist on the mountains towards Yarkund; but their colour and size, as well as general habits, remain to be described.—*Ibid.*

GENUS CAPRA, Wild.

28. Capra Ibex.* Found on the Tibetan slopes of the Himalaya, and in the other high mountains of Tibet, north of Lassa and Digurchee, as well as towards the frontier of China. Have no specimen thence.

29. Genus Capra, tame. The shawl goats, of which there are three races, diminishing in size from the common or standard one, abound all over Tibet, almost to the exclusion of other species. The finest breed is that of Nâree or Eastern Tibet, near the snowy region : but the wool is good all along the Hemâchal on both slopes, and some years ago the minister of Nepal established at Katmandoo a colony of Cashmirees to make shawls. Why not we in Kumaoon, or West of it ?

GENUS OVIS, Wild.

30, 31, 32. Three species, Ammon, Ammonoïdes and Nāhŏor. All are said to be found in the mountains of the interior of Tibet, as well as on the Tibetan slopes of the Hemâchal, where, however, the Nāhŏor species is the most common ; but I have lately received a fine pair of horns, with the frontlet attached, of Ammonoides vel Ammon, *(si sic decretum fuerit,)* from the same region ; viz. the Mustang district. Ammon the monster, with the monstrous horns, is, I believe, distinct and most common in, if not limited to, the Tartar regions confining with Tibet on its *North*. Mr. Blyth's Ovis Burrhel is no other than my Nāhŏor, Mr. B.'s specimen of which was dyed brown by a preservative lotion that was applied by the killer and curer of it, Lieut. Smith, 15th N. I. ! !†

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* *C. Sakeen*, Nobis. Distinct from the Alpine Ibex, and still more so from that of Siberia.—*Ibid.*

† There is a Rowland for Mr. Blyth's Oliver, given however in all courtesie. The local Naturalist must be pardoned a smile when the Master of a Library and Museum, confounding the essentials with the accessories of species, edits a new being as unskilfully as his unprovided ally of the field department.

Note by Mr. Blyth.—Mr. Hodgson will, I trust, consent to suppress his smile, and thus further extend his courtesie to me, when I inform him, that I was originally induced to distinguish *Ovis Burrhel* from *O. Nahoor*, in consequence of the decided difference in the sectional form and general aspect of the horns of these two species. I happened to be employing an artist to draw the specimen of *O. Burrhel* in the Zoological Society's Museum, when chancing to take up a frontlet of *O. Nahoor* that was lying beside me, and holding it to the stuffed Burrhel's head, I saw at a glance that they were distinct species, and I subsequently (as mentioned in my paper on the species of wild Sheep) met with another specimen of a Burrhel's horn, wherein the specific character was equally well marked.

The ears of *O. Burrhel* are also conspicuously shorter than in *O. Nahoor;* and the tail appears to be reduced to a mere rudiment: it has been thought, indeed, that the

33. Genus Ovis, tame. Vast flocks of the graceful and valuable Hoonia are reared all over Tibet, for food, clothing and carriage, and exclusively almost of any other breed. They flourish also in the Kachar of Nepal, though not south of it, and even in the Kachar their wool degenerates. To procure the Hoonia from north-eastern Tibet, ought to be an object of zealous endeavour on the part of the Agricultural Society, which should likewise obtain the Kachar breed of the same animal, the former for export to Europe, (for it would not live in India,) the latter for attempts at crossing with the common long-tailed breed of Gangetic India. The Goats and Sheep of the Hemâchal and Tibet have the finest fleeces in the world: the Goats and Sheep of the plains of India, almost the worst.* Should the rulers of the latter region not essay to make their apathetic subjects profit by the circumstance?

CERVIDÆ.

GENUS CERVUS.

34. Sub-genus Pseudo Cervus, C. Wallichii. This species is alleged to tenant the plains of Tibet in hilly and woody situations, as well as the Tibetan slopes from the spine of the Hemâchal. But I have no further

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tail of the Zoological Society's specimen had been lost, but on minute examination I arrived at the conclusion, that the whole skin of this part was present, though longitudinally divided, and what confirmed me in this belief was, the circumstance of the *pale space* that should be covered by the tail being exactly of corresponding dimensions to the size of what I judge to be the whole of this appendage; of course, I allude to the appearance as if *etoliated*, which contrasts in this respect with the colour of the surrounding parts.

Of the veritable *Nahoor*, I have seen some considerable number of horns, (there are four frontlets of males in the Asiatic Society's Museum,) but never any that I could mistake for those of the Burrhel.—Comparative figures of them are given, along with those of other species described by me, in the *Annals and Magazine of Natural History, for September*, 1841; where, however, the names are unfortunately transposed, the appellation Nahoor being affixed to the Burrhel, and *vice versá.*

With respect to *O. Ammonoides*, Hodgson, should it really prove different from *O. Ammon*, it will be remembered that I had dedicated this animal to Mr. Hodgson himself, terming it *Hodgsonii*, some time before the publication of the name *Ammonoïdes;* so, likewise, Capt. Hutton's designation *Cycloceros*, applied to the wild Sheep of the Hindu Koosh ranges, and which, by the way, is equally applicable to the Corsican *O. Musimon*, must yield to my prior name of *Vignei.*

Mr. Hodgson, in his *trans-nivean* researches, should strive to procure some information respecting my superlatively magnificent *Ovis Polii*, to which even the "monster *Ammon*" yields precedence for grandeur, as it assuredly does for elegance and beauty. The only locality at present known for this fine species is the Steppes of Pamir.— E. B.

* The Agricultural Society or any other body may command my willing services in aid of any exertions to improve the fleeces of our Indian or English Sheep.

specimen thence. That from which the original description of Hardwicke was taken, was obtained alive from Muktinath in the Himalayan region of Tibet, and considerably beyond the boundary of Nepal. Than such a habitat nothing can be more diametrically opposite to the Saul forest of the Morung, whence our Cervus Affinis was procured; and I therefore still believe in the distinctness of the two species, the more particularly as I conceive that the small disparity of age between the specimens compared is inadequate, even with the aid of other admitted differential accessories, to account for the vast and palpable differences exhibited by the horns. Mr. Blyth allows but about a year's difference of age between the specimens; yet the horns of Affinis are much more than double the size of those of Wallichii (as 9 to 4) whilst what he insists is the median, and I the subterminal, snag of the horns of Wallichii, has an interval from the basal snag as large nearly as in Affinis. Wherefore I say the snag in question of the horns of Wallichii is not a median; and that the species wants that significant mark of the true Elaphoid form.* Lastly, Wallich's stag is known to the Nepalese by the name Gyâna Mriga; Affinis, by that of Mool Bara Singha, that is, chief or royal stag; and I deem it generally prudent to rely on distinctions attested by this sort of evidence.

MOSCHIDÆ.

Genus Moschus.

35, 36, 37. M. Chrysogaster, M. Leucogaster, M. Saturatus. All these species abound in the lofty mountains of the interior of Tibet, especially towards the Chinese frontier, where the first and loveliest, or Chrysogaster, is almost exclusively found. On the Tibetan slopes of the Hemâchal. Saturatus chiefly resides, and it is difficult to distinguish this species from the Moschatus of Linné, belonging to the interior, otherwise than by the coarser structure of the musk pod, and inferior quality and quantity of its contents (on an average) in Saturatus. I have specimens of all three species from Lassa and Digurchee, whilst my garden is seldom deprived of the ornament of several live samples of the Saturatus of the Kachâr. The trade with Europe in Musk is declining greatly of late, probably because its repute as a medicine is becoming fast exploded.

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* Mr. Hodgson should bear in mind, that the horns which he refers to are, most obviously, those of a young animal which had not assumed their typical conformation.—*Cur. As. Soc.*

Much is still sent to China, and chiefly from the Dokpa district, six stages east of Lassa. It is, *par excellence*, the Kaghaze, that is, thin-as-paper pod, and is principally obtained from M. Chrysogaster.

GENUS EQUUS.

38. Equus Caballus, tame. From China to Bokhara through Tibet, there are found few or no horses, but a great variety of ponies, all remarkable for their excellence for mountainous travelling. Towards and in China, the breed appears to be the smallest and highest spirited, shewing as much blood as the finest Java pony. Towards and in the Himalayan districts, there is more size and bone, but less fire. The breeds of Eastern Tibet, such as the Poomi and Gyanché, best unite the two properties of the others, or strength and spirit; whilst towards *Western* Tibet, there is a gradual increase of size till you reach the Choughosa "Cob" of Samarcund and Bokhara. In most of the Cis-Himalayan districts, likewise from Kumaon to Deo Dharma, "Hill ponies," as we call them, are bred, but none of them equal, I think, to the Trans-Himalayan races, among which I prefer that of Lassa, a smallish breed, but stronger and larger than the gallant little "Chinia," and not materially or inconveniently less resolute or animated. The proposed Gorkha corps of mounted riflemen should, if possible, be furnished with some good breed of these ponies.

39. Equus, wild; E. Kiang, Moorcroft; E. Hemione, Auct.? Found generally throughout Tibet. I have no specimen.*

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* Mr. Moorcroft remarks of this animal ('Travels', Residence at Ladakh, I. 311), that "it is certainly not the *Gurkhor*, or wild Ass of Sindh," which is the Hemione; see also p. 443 of the same volume for some description of this Kiang, which Dr. Gerard met with "in great herds" on the Himalaya, at an altitude of 17,700 feet; indeed it appears to be essentially a mountain animal, which "bounds up the rocks" with speed and facility; whereas the Hemione is rather an inhabitant of the sandy level. Col. Hamilton Smith, in his admirable treatise on the *Equidæ*, (*Nat. Libr.*, *Mam.*, XII,) conceives the Kiang to be one of several existing wild species of true Horse, and suggests that the "wild Asses" of Bell, with hair "waved white and brown," some skins of which were seen by that traveller near the sources of the Oby, may refer to no other; but this is mere conjecture, and Col. Smith appears to me to be little warranted in his endeavour to derive the pie-bald races of horses from this peculiar stock.

I may take this opportunity of remarking, too, that I entertain considerable doubts as to whether the reputed "wild Ass" of Prof. Gemelin be aught but a variety of the Hemione: the female observed by that naturalist had no cross-stripe over its shoulders, such as was found in the male, and is, so far as I have observed (and my attention has been long directed to the subject), invariably constant in the domestic Ass; whereas in the Mongolian *Onager*, M. Gmelin was informed that the mark

40. Asinus Equioides, Mihi. Species wants verification, spoken of by Moorcroft and others: called wild Ass by the Tibetans, and said to be common on the plains of Tibet. Possess no specimen.

RODENTIA.

MURIDÆ.

41. Genus Mus. Rats and mice are said to be common in Tibet, but I have no specimens, and cannot therefore indicate species.

42. Genus Sorex. One small species, Tibetanus; no describable specimen.

43. Genus Arctomys, A. Hemalayanus. Possess many skins from the interior of Tibet, where the species is very common, and where also are found some rarer murine forms that I have no means to illustrate, such as the one adverted to by Moorcroft (I. 312). The traders of Nepal of the Newar race, who are often domiciled in Tibet, upon seeing my specimens of Rhizomys Badius, assure me, that this is the ordinary house rat of Tibet, and no other than the animal indicated by Moorcroft.

referred to is by no means constant (as his two specimens testified), and sometimes there is even a double cross-band over the shoulders. Now with respect to the undoubted Hemione, I may remark that an uncommonly fine male, which is probably still living in the Surrey Zoological Gardens, has a very distinct incipient cross over its shoulders, more developed on one side than on the other, though not above an inch or so on the former; and therefore it is probable enough, that some examples of this species may have the same mark further developed. Whether the *Khur* of Sir R. K. Porter ('Travels,' I. 459), be specifically different from the *Ghore-khur* or *Gurkhor*, i. e. the *Hemione* of modern naturalists, remains also to be ascertained. Of this we are informed, that "no line whatever ran along his back, or crossed his shoulders, such as are seen in the tame species with us;" but "the mane was short and black, as was also a tuft which terminated his tail:" and it is worthy of notice, that this traveller completed the sketch which he has furnished of this animal from a second individual. Certes, a wild Ass, or Hemione, of some kind, exists at the foot of Taurus (Ainsworth's 'Travels in Assyria,' &c., p. 41); the same or another "is common in the districts of the Thebaid" (Wilkinson's 'Domestic Manners of the Ancient Egyptians,' III. 21); and a "wild Ass" is mentioned in the narrative of Lander's Expedition (p. 571); but of the genuine and indisputable wild *Equus Asinus*, we really possess no definitive information whatever, that should satisfy us of its present existence, however little reason there may be to doubt this; the *Onager* or *Koulan*, as we have seen, being very probably no other than an occasional variety of the *Hemionus*, and the *Hamar* or *Hymar* of Sir R. K. Porter, if really distinct from the last, which is very probable, being still more different from the common tame Ass, since it has no dorsal marking whatever, and the cross stripe of the so called *Onager* even was considerably less developed than in a domestic Donkey. I look to the establishment of Mr. Hodgson's *Asinus Equioides* with much interest; and indeed all the aboriginally wild Equine animals of Central Asia, if we except the modernly termed *Hemionus* alone, are but very vaguely known at present to Zoologists, and should be minutely described by whoever has the good fortune to meet with one.—*Cur. As. Soc.*

Lagomys Nipalensis, again, they allege to be the ordinary field rat of that strange land, *Sed quære?* Rhizomys is too tropical a form for Tibet.

44. Genus Lepus, L. Oïostolus. Common in Tibet near the Hemâchal, and expressly pointed out by Moorcroft (I. 225): but not so common in the central and eastern provinces of Utsâng and Khâm, as the next and much larger species.

45. L. Pallipes, White-foot, new, Mihi. Essential structure perfectly typical: particular conformation approximated to that of Hibernicus and Variabilis: fur very soft and full, as full as, and much softer than, the English hare, and of two sorts, the inner rather more abundant and wavy, the outer, not much longer, straight, and possessed of an uniform structure with very little rigidity, or rather with a slight elasticity and no rigidity. Size of Variabilis, but with ears equal to the head. General colour the ordinary hue of the English species, but paler, with less of red and still less of black in it, and the pads yet more completely enveloped in their socks: Groove of the front teeth very deep: whiskers medial, black or white. Body above, except the buttocks, with the whole toes and a list down the fronts of the limbs, pale rusty yellow or ruddy luteous, very moderately sprinkled with black. Ears outside towards the back on the distad opposed halves, with the nape, the buttocks and the limbs, bluish hoary, white almost on the ears and limbs; body below rufescent hoary; rufous on the chest and white under the chin. Ears largely tipt with black (for half an inch): Tail white. Inner fleece inannulate and bluish hoary. Outer piles triannulate with two black rings and one intervening pale rufous zone, none of these latter wholly black, nor longer nor harsher than the rest. Snout to rump 22 to 23 inches, head 4¾, ears 4¾: Oscalcis to longest toe, 4½: Scut without the terminal hair, 4 inches, with it, 6.

Remark. Possess two skins from Lassa and one from Sikim, which however came, no doubt, from beyond the snows originally. I am indebted for it to Dr. Campbell's kindness. The species is that common to all central and eastern Tibet, (Utsâng and Khâm): but in the higher and more mountainous sites of Western Tibet, or Nâree, and also in Ladakh, Oiostolus is the more prevalent species. Macrotus, or the Indian type, (up to the Himalaya) never crosses the snows, nor is known in Tibet.*

* The *Lepus tolai* of Pallas, "an inhabitant of open hilly places in Dauria and Mongolia, and said to extend as far as Tibet," should be enquired for by Mr. Hodgson. A description is given in Shaw's Zoology, II. 203.—*Cur. As. Soc.*

46, 47. Genus Lagomys, L. Nipalensis et Royli. Both are said to be very common in Tibet, even much more so than in the Himalayan districts: but I have no specimens from beyond the snows, and trust to native information upon sight of the skins in my possession. The whole ground on the way from Kooti to Digurchee is said to be often covered by immense groups of Lagomydes, whose burrows render the roads unsafe for horsemen. The Arctomides collect in the same manne[illegible] in much smaller numbers.

Nepal, 2d April, 1842.

N. B. Those who would consult this Tibetan Catalogue with advantage, had better first refer to the Catalogue of Nipalese Mammals, published in the last No. of the Journal.

Plates attached to this Paper.

1. Vulpes Ferrilatus.
2. Felis Nigripectus.
3. Lepus Pallipes.
4. Ovis Hoonia, tame.

Some concluding Remarks forwarded for insertion with Capt. TREMENHEERE'S *Report on the Tin Ground of Mergui.*

Of the existence of tin in considerable quantities in the province of Mergui, there cannot, from the facts above stated, be much question; and from the trial of the produce of one man's labour in a given time, there appears to be sufficient to justify every expectation of a profitable employment of labour on an extensive scale.

The places at which the trials were made, were not selected as the best from previous information, but were arrived at more by accident than design, and the stanniferous gravel and sand collected where the bed was tolerably level, stream slack, and where the greatest deposit appeared to have recently occurred.

No part of the bed of the Thabawlick, which was examined, was found wholly destitute of tin, and it is reasonable to conclude, that the ore exists in numerous spots, especially in the vicinity of the hills from which the streams arise, in far greater abundance than is shewn above.

The results, therefore, which are given in detail, can only be considered rough approximations to the quantity of tin these streams would afford, and to the probable out-turn with an establishment properly superintended. Much economy in labour might be effected in collecting the sand and gravel for the washers, but no better mode could, I think, be adopted in separating the tin in the first instance, than by people accustomed to work with the flat conical-shaped troughs before described. The quantity obtainable, would fully repay the employment of men in this operation.

The tin, as produced by the washers, should be placed on sloping boards, and water conducted over it from a trough pierced with holes for the purpose, in order to get rid of foreign particles; and it would then, after being finely pounded, be ready for smelting. Of all metals tin is in this process the least troublesome, after the ore is freed from the earthy and silicious particles with which in other countries it is often mixed.

The crystallized form in which it here occurs, renders its separation extremely easy, and the whole processes of stamping and dressing, which in England are tedious and expensive, can thus be dispensed with. No arsenic or sulphur being mixed with the ore, it need not be roasted before it is placed in the smelting furnace.

It would thus appear that the tin of the Mergui province offers no ordinary inducement to the outlay of capital, without much of the risk, uncertainty, and large previous outlay usually attending mining adventures.

G. B. Tremenheere, *Capt.*
Superintendent of Forests, Tenasserim Provinces.

Errata in the printed Report.

Page 846, line 10, et passim, for Thengdon, read Thengdaw.
—— 848, ,, 16, for Pak chum, read Pak chan.
— 849, ,, 17, for Loundoungin, read Londamgiu.
— 849, ,, 18, for Wolfran, read Wolfram.
— 850, ,, 33, for 63-176 grains, read 6 oz. 176 grains.
— 851, ,, 14, for Kohan, read Kahan.

On the Cotton called "Nurma," in Guzerat. By A. Burn, Esq., *Superintendent of Cotton Cultivation, (in reply to* Mr. Piddington's *Queries.) Communicated from the Secretariat, General Department.*

The plant yielding what is called Nurmah cotton in this part of the country, is the same as is described by Dr. J. F. Royle as Glossypium Arborium. It is to be found growing wild, I believe in different parts of India, and from some experiments I made when at Kaira, I have very little doubt that it will be found to be the original stock from whence the Barbadoes, Bourbon, Egyptian, and Sea Island varieties have originally sprung,

It grows in every kind of soil that is met with in Guzerat. But it obtains the greatest perfection in light sandy soils, to which a little old cow-dung manure has been added, and where it can have a *proper drainage,* in the black clayey soil, known as "the cotton soil" of the indigenous G. herbaceum; it grows, but with diminished vigour in proportion to the purity of that soil. In a state of nature, and when fully developed, the seeds are nearly as large as a particle of grain, and are closely covered all round by a strongly adhering bright pea-green coloured fur, and enveloped in a fine silky wool of considerable strength, and fully an inch in length.

Hedgerows, gardens, groves of trees about the abodes of devotees and temples, are the places where this plant is found. I don't know of its being cultivated in any other way. In these places it is a perennial, lasting for four or five years or more, and being cut down to within two feet of the ground in the end of June, or a little before the setting in of the annual rains; this also is the best time for sowing the seed.

The natives appreciate this cotton, from its fine staple enabling them to spin finer thread than from any other kind with which they are acquainted. Muslins and long pugries for the head are made from it; but since the introduction to this country of European products of the loom, its use and its culture have been so reduced, as hardly at this day to afford sufficient evidence to save their being classified along with the fabulous stories of Hindoo history.

Of the quantity produced per acre, I can give no estimate; but in the first year, it could not be over 100 lbs. of clean cotton. In the second year, as the plant then comes into full bearing, it might be from three to four hundred pounds. The great extra labour and expense over the common crops, of protecting the fields during the whole year, which the cultivation of this plant would entail, is, I believe, the main obstacle to any attempts being made to cultivate it. Here we have no hedgerows, and nothing that is well calculated for such a purpose; all the agricultural produce being from annuals, the ryot protects them from cattle, thieves, &c. by living in his fields during the few months they are ripening, and which he could not do for a longer period. The price of this cotton in the bazar, is always double that of the common country article. However, there is never more than a few pounds procurable,

I have for several years back entertained great hopes in regard to this cotton, particularly that it may be improved, so as to become of value, by attending to modes of culture. That from it new varieties, suited to different soils and situations as regards climate, may be obtained, is more probable than from any of the cultivated kinds, and I have hoped that circumstances might some day admit of my being able to attempt its culture as a perennial, in the same way as cotton is grown in Peru.

Samples of the Nurmah cotton are forwarded with this letter, procured from different places in and about the city of Broach. As regards soils, I cannot at present obtain any such as could be of use to Mr. Piddington; but when I am relieved from the medical charge and duties of this place, I shall then be able to select, in visiting the country round, proper specimens.

Broach Office of the Superintendent of American
Cotton Planters, 6th January, 1842.

On an Ancient Magic Square, cut in a Temple at Gwalior. By Captain SHORTREEDE.

As every thing tending to throw any certain light on the antiquities of India has an interest, I send you the following inscription of a Magic Square, which I copied last year from an old temple in the hill fort of Gwalior. It bears the date सम्वत १५४० = A. D. 1483.

The temple is on the northern side of the hill, and at one time it has been a very magnificent edifice, though now it be sorely dilapidated.

It has formerly suffered from the rude hands of the Musalmans, and more lately it has been excavated under the site of the image to the depth of twenty or twenty-five feet, in the vain hope of finding hidden treasure.

There is another and larger ancient temple in the fort, of a peculiar form, which the Musalmans have converted into a Musjid.

If I remember rightly, the Magic Square is cut on the inner side of the northern wall, close to where the excavation has been made. I did not measure the dimensions; but the form is as follows:—

१६	९	४	५
३	६	१५	१०
१३	१२	१	८
२	७	१४	११

सम्वत १५४०

The properties of the square are, that in every way, whether vertically or horizontally, or diagonally, the sum of the numbers is 34: the diagonals may be summed either in one line as usual, or in two parallel lines; containing together four numbers thus:—

$$34 = \begin{cases} 16+6+1+11=3+12+14+5=13+7+4+10=2+9+15+8 \\ =16+10+1+7=9+3+8+14=4+6+13+11=2+12+15+5 \end{cases}$$

It will be observed, that the places of the numbers 1, 2, 3, 4, form a rhomboid, as do also 5, 6, 7, 8; 9, 10, 11, 12; 13, 14, 15, 16. It may be remarked also, that the sum of every two alternate numbers taken diagonally is 17: and that all these properties will hold good if the lines be transposed vertically or horizontally in the same order; that is, if the top line be brought to the bottom; or if the left hand vertical line be carried over to the right.

The whole displays considerable ingenuity, and in connection with the date, may be of use as indicating the former state of arithmetical knowledge.

8th April, 1842.

I add a copy of the inscription in our common numerals, in case it may be wanted, as also a sample of the way in which it may be extended, which probably is similar to that in Dr. Franklin's Magical Square of Squares, but on this point I cannot speak positively, as I do not distinctly remember the particulars of Dr. Franklin's Square of Squares, and have at present no means of reference.

16	9	4	5	16			
3	6	15	10	3			
13	12	1	8	13	12		
2	7	14	11	2	7	14	
	9	4	5	16	9	4	
		15	10	3	6	15	10
				13	12	1	
				2			

Report upon the Construction of Philosophical Instruments in India. By Captain J. Campbell, *Assistant Surveyor General.*

It is, I believe, the intention of Government, that the proposed Madras University shall be an institution in which the principles, or even a complete knowledge, of the Physical Sciences, shall be taught to those who are willing among the Native community.

For this purpose, as apparatus for the lecture tables, and for the exhibition of the principles of machines and the various experiments in Chemistry, Hydrodymacis, Pneumatics, and the effects of Light, a set of instruments will be required, which as adapted for any institution called an University, cannot be procured at a less outlay than £10,000 at least.

It is this set of apparatus which I propose making up in India by the hands of native workmen only, at probably an outlay of little more than 5,000 rupees for the whole, and of such workmanship and finish as to be comparable, if not as good, as the best which London can produce.

I believe no one, either youth or adult, who was at all interested in the pleasures of the pursuit of science, has ever left a lecture room in London without a secret wish, that he could himself repeat the experiments he has seen performed, and a regret that the apparatus required were beyond his means; and no one intimately acquainted with the character of Natives, and with the keen vivacity with which they regard any thing new or wonderful, will doubt the feeling of regret and humiliation with which they must regard the beautiful apparatus as finished by European workmen ; while they examine a balance which takes nearly two minutes to perform a single oscillation, and wonder how it can be made to move so slow and regularly, and which is capable of rendering sensible a quantity no greater than the millionth part of the load which it sustains; when they are told that such an instrument cannot be purchased for less than 500 rupees, and that its execution is utterly beyond the capacity of the Natives of India, and that no instrument submitted to their inspection can they ever be permitted to handle or to use, and if not in affluent circumstances hardly any of the simplest can they ever hope to purchase. It may happen that the idea may strike them, that under such circumstances, what may be the value of listening to an abstract detail of philosophical facts, which they can never hope to investigate themselves, or to prove to their own satisfaction, that they are founded upon truth.

Besides this, the practical application of scientific knowledge can never be turned to account, without a familiar knowledge of the technical mode of exemplifying it.

On the contrary, how much it must assist a teacher of science in being able to fix the attention of his auditory by telling them, that there is not an article exhibited to their view, beautiful and wonderful as they at first may appear, which has not been made by Natives of India, at a price which any but the most indigent can afford, and which any one may become capable of constructing, if they pay attention to the explanation of the principles upon which the instruments have been formed.

That Native workmen are capable of this I have endeavoured to shew in a former report, and have instanced in the allusion to an instrument with regard to the powers of which I may mention, that Sir John Herschell, in his Discourse upon Natural Philosophy, has thought it necessary, for fear the fact should be doubted, " to assure the reader that balances have been constructed capable of rendering visibly sensible, a quantity of matter to even the millionth part of the whole ;" yet this, which by the passage is evidently considered a great effort of mechanical skill, I have been able to effect by the hands of an Indian workman, totally untaught, except by myself; and with regard to its outward appearance, no one who has yet seen it but has remarked, " How beautifully it is worked," or that " no one would for an instant believe that it was made in India."

It might be remarked in contravention of my propositions, that I endeavour to assert the possibility of rivaling in India the productions of the genius of Ramsden and Troughton, and that the idea is absurd; but however, such it is my intention to assert.

However preposterous the proposition may at first appear, yet it may be shewn, that there is nothing impossible in its execution, for it will at once be seen by any one acquainted with the subject, that the instruments by the aid of which the investigations by which our present knowledge of the laws of matter and unponderable substances have been conducted, owe their excellence not so much to the skill of the mechanical workman, as the ingenuity and talent in adopting means of product to the desired purpose, as shewn by those who directed the construction.

And in fact, what are the beautiful and costly instruments, the expense of which is only within the means of nations, and to which are due the proofs of the profound investigations of modern Astronomy, but large masses of metal, the true form assumed by which at each change of position, has puzzled the investigation of the most penetrating and ingenious, and has caused a competent judge to remark, " that the " observations made by a circle of only 12 inches diameter are better, " and more worthy of confidence than those procured by all the 3-feet " circles, and even the 8-feet circle of Ramsden, which have yet been " constructed," and what are the divisions upon them, but a rude attempt, (as referred to what future ages may produce), to divide the circumference into 189,600 parts, which instead of being equal parts, often differ to the amount, ″5 of the circumferences and always to 1″.

From their unimpassioned character, their slow and quiet habits, their delicate appreciation of touch, and their untiring application, it is probable that a clever Native, if once taught properly the art of dividing the circumference of a circle, might very probably surpass the best effects of the most celebrated workmen of London.

It is supposed by many, that modern discoveries in Optics have improved refracting telescopes by the lenses being better made; but such is not the fact, the lenses of the present day are not in the least better than that Galileo and Heygens were able to make, and it is probable there is hardly a Chinese workman, who does not possess a great deal more skill in polishing a lens, than the best optician in London. I once bought in London a Chinese toy, an imitation of a compound microscope, from which I took lenses so beautifully polished, as to be admired by one of the first opticians in London; and I have little doubt, that a clever workman in India could fashion lenses, with which a refracting telescope could be put together, quite as good as the best which Tully or Dolland ever made.

The above may appear a startling assertion, but no optician will deny the possibility of its being correct; for the fact is, that workmen are totally unable to give a particular required figure to a lens, and lenses of required focal distance for forming the achromatic object glasses of the best telescope, can only be procured by selecting the best among numerous failures, (whence the high price), and modern science has only improved these instruments, by teaching the proper theoretical principles upon which to compound their various parts.

In the above, it is by no means my intention to attempt to detract from the merit of the constructions of our best artists, but merely to shew, that the perfection of modern instruments is due more to the skill by which their parts are contrived and arranged, than to the mechanical skill by which the parts are executed.

It is generally imagined by Native workmen, and by many gentlemen in India, that with a pattern to copy it is easy to make any thing, this is, however, very far from correct; for unless shewn how to do it, it would be as impossible to construct the simplest philosophical instrument, as it would be to copy a telescope, or a chronometer, by the aid of a pattern only.

It is possible, besides, that the country may afford many advantages for the manufacture of philosophical instruments, which have not yet suggested themselves to me; but among these, prominently occurs to me the opportunity of constructing a suferior glass for forming the lens of telescopes, a desideratum, which in England opticians have sought in vain, from the obstacles thereto in the way by the operation of the laws of excise, while in India no obstacles of this kind exist. The materials for making the finest glass are cheap and plentiful, and it is well known, that the famous glass made by M. Ginnund, of which the great Dorpat telescope is constructed, was made in small experiments upon less than two hundred weight of materials at one time.

For making a complete set of philosophical experimental apparatus, India affords all the materials required, with the exception of glass, whence it will be necessary to purchase in London all the glass chemical apparatus for the electrical apparatus, receivers for air-pumps, and for the lenses of the optical apparatus; but as the expense of these articles at the glass-house is but little, it will form probably but a very small item in the outlay.

With the modes of executing the proposed instruments, fitting electrical machines and grinding lenses, I am perfectly acquainted, from having made them for my own use while in England, and from having had the advantage of inspecting, and using the best which have been in London, and from having had the opportunity of seeing the workshops of many of the most eminent philosophical instrument makers.

Rayacottah, 5th October, 1841.

Manual of Chemistry. By Capt. J. Campbell, *Assistant Surveyor General, Madras.*

PREFACE.

This work was planned several years ago, in consequence of the difficulty which I found in procuring practical information in fitting up a small laboratory for investigations in the Chemical composition of rocks and minerals. Some parts have been for a long time compiled as a set of notes for ready reference, and have been altered and corrected, as further investigations and experience rendered it necessary. It was my intention to have published the part upon Action of Tests, but it was laid aside upon finding that the late Lieut. Braddock of

Madras, had compiled notes for a similar purpose; his death having unfortunately prevented a revision of his first valuable, though crude, little publication, I have therefore made use of his able abstract of Rose's work, with such corrections and alterations as I considered necessary, and it has been necessary to rewrite nearly the whole.

It was not my intention ever, with my present experience, to have so soon undertaken the authorship of a compilation upon the subject; but having been applied to by the Rev. Mr. Garrett, of the Wesleyan Mission, for a work adapted for the Natives of this country, who might be anxious to acquire an elementary knowledge of chemical science, and finding that Dr. O'Shaughnessy's excellent little Manual was out of print, and there being no work printed in England, at all adapted for the perusal of Natives, I have determined on commencing at once the preparation of a work adapted for the purpose.

As the labour and time required for writing a complete work of this kind would be greater than my pursuits and official occupations would enable me to spare for the purpose, Mr. Garrett has agreed to share with me the labour of compilation, and he has therefore undertaken to draw up the part descriptive of the chemical elementary substances.

While so many excellent treatises upon the different branches of Chemistry exist, no originality can be expected in a work of this kind, and it must be therefore regarded, merely as a compilation of the information from other works, abstracted, condensed, and made as practical as possible.

In endeavouring to lead the Native student on to a general view of the useful application of Chemistry, it has not been forgotten, that the subject may combine with that brief and assorted information which renders the work a "Manual of Chemistry," which will be useful, as it is hoped, to those gentlemen in India, who possessing an elementary education upon the first principles of Chemistry, are yet deterred from the practical uses of the science, by the remembrance of the extensive and costly apparatus which they have seen used by their instructors in Europe.

The Native medical practitioner will find a knowledge of this science of the utmost value in assisting him in arriving at a knowledge of the composition of the various mineral productions which the country affords, so as to enable him to ascertain what may be useful to him, and also enable him to prepare economically and independently of the manufacture in Europe, those chemical preparations which are found so valuable in European medical science. It will enable him to correct and to apprehend the absurdity of many incongruous preparations now ignorantly made use of by Native practitioners, and understand the effects of many which are very mischievous.

A knowledge of Chemistry will enable him to ascertain the quality and properties of the juice of plants, and the decoction of leaves and bark of trees, many of which have been found very valuable in Native practice, and which afford to the skilful chemist a cheap and economical substitute for the more costly chemical preparations employed by Europeans.

It will enable him to prescribe antidotes for the frequent attempts at murder, perpetrated but too often with impunity by poison, among the Native community, upon the slightest personal pique, or feeling of revenge or resentment; but which will receive a severe check from a certainty of detection and conviction, if persons competent to examine into the circumstances were at hand.

To the European amateur, extensive opportunities for the useful and gratifying practices of Chemistry present themselves, with investigations of the mineral resources of the country. In the investigations of the properties and composition of the juices of numerous plants and trees indigenous to this country, but which in Europe cannot be obtained, except in a state of partial decomposition; and the oriental chemist has thus laid open to him a vast field of research, in the pursuit of which he may find the highest gratification, and engross to himself opportunities, which the perhaps more generally skilful chemist of Europe may envy in vain.

If his ambition lead him to seek a higher field, and measure his skill against that of European proficients, there are numerous chemical compounds which have been as yet but imperfectly examined, and upon which his analytical researches may be most usefully employed; while the extensive leisure which many of the officers in the employ of the Government possess, the cheapness of fuel and labour, may enable any one, if he is diligent and enterprising, to seize upon some of those honors which distinguished scientific knowledge has ever received in all countries.

In Europe, where the works of authors are offered for sale, the public have a right to criticise their value, and manner in which the authors have executed their task. In the present case it is far different, the purpose of the work is above criticism, the execution beneath it. The expediency of an attempt to diffuse knowledge will be denied by none, and is indeed the object of the press from which it issues. The imperfections of the execution is a necessary consequence of the limits of the work, and will be attempted to be improved, should public opinion call for another, and more extensive, and of course more expensive edition.

The practical applications of chemical science for the purpose of trade and gain are very numerous.

Carbonate of Soda can be readily and cheaply made by simply crystallizing the solution obtained by lixivating the Soda Earth, (Chour Munnoc,) of the soils of many parts of South India.

Carbonate of Potash can be made by deflagrating Saltpetre with charcoal in an iron pot, (vide description of process under head of Potash from Cocoanut Leaves, Indigo Stocks, &c.)

Prussiate of Potash can be very readily made in India, as well as in England, and as it costs there 7*d.* a pound, and the material required, and the labour are very cheap in India, and the iron pot required easily procured from England, or may be even made in India, it may be made a profitable article of manufacture, (vide description of process of Manufacture.)

Acetic Acid may be made from the decomposition of Wood, (vide process), or by the decomposition of Alcohol by powdered Platina, as Dr. Ure informs us is actually and profitably employed in some parts of the Continent of Europe, where Alcohol is cheap, in converting it into vinegar; it of course can be still more profitably used in India, where Alcohol is still cheaper. Acetate of Soda might be manufactured for importation to England, for the purpose of decomposing it for the manufacture of Acetic Acid, in case the Excise Laws in England should cause a difficulty to the import of the Acetic Acid, or in case Sulphuric Acid cannot be procured at a sufficiently cheap rate in India.

Muriate of Morphia may be readily made in India, for 1-100th part of the price in Europe, as Opium is sold in many parts of India at a very low price.

Indian Steel or Wootz, is very lightly prized in Europe, and the objection to it is the great expense required to fuse it in England, in consequence of the imperfect state in which it is manufactured by the Native workmen, who are ignorant of the principles of the process.

Sulphuric Acid may be made in India much cheaper than in England, because the Sulphur and Saltpetre required are both mineral products of this country, and of course its application in the manufacture of Nitric Acid, Muriatic Acid, and Acetic Acid. In making Chloride of Lime for use in bleaching, in dyeing, &c., and numerous others will follow of course.

Pyroxalic Spirit is another product in the decomposition of wood, which fetches a high price in England, and might be useful for producing light in India, where wood is so plentiful and cheap.

Acetate of Lead is another form in which Acetic Acid might be combined as an article of commerce, (vide process.)

Acetate of Alumina is another form in which Acetic Acid might be combined as an article of manufacture of great request in dyeing.

Phosphorous is a product which might be made in India, and afford an instance of the application of Sulphuric Acid.

Citric Acid is very expensive in England, being made exclusively by decomposing an Alkaline Citrate, but which might be cheaply made in India from Limes.

Citrate of Soda or Lime might be cheaply made in India, (vide process), and as the fruit is so abundant and cheap, could be made at less expense than Tartaric Acid.

Vinegar cheaply and readily made by the fermentation of a solution of sugar, and as the sugar is so cheap in India, the coarse inspissated juice selling in many places for eight annas per maund, which yields by fermentation — parts of vinegar of the common strength, it can be made for — a gallon.

The Pipe Clay of Arcot, and probably of other parts, affords the means of making Pottery of the finest kind in India.

The Kaolin of Mysore affords the means of making the very finest kinds of Porcelain at little expense, and may be more generally employed in making crucibles and melting pots for metals, or fire bricks for lining furnaces.

Glass also may be an article of manufacture, as the finest kinds of quartz are abundant in South India; and soda required for a flux and wood-fuel are abundant.

Tartaric Acid may be produced as an article of manufacture by saturating the excess of Tartaric Acid in the [illegible] of the fruit of the tamarind tree with lime, (vide process,) and will be a useful article much required in dyeing; or perhaps the Tartrate of Lime might be introduced into England as an article of commerce.

Alum might be made from the Aluminous Shale said to abound upon the Western Coast.

Prospectus.

Part I. Introduction, Principles of Chemistry, Explanation of Nomenclature.
  Sect. 1st. Chemical combination.
    Modes of
      Solution
      Chemical mixture.
    Effects of
      Change of form.
      Change of density or bulk
      Change of temperature.
      Alteration of the action of Heat.
      Change of Colour.
  Sect. 2d. Affinity and tables of,
  Sect. 3d. Laws of combination—Atomic.

Theory.

    Theory of volumes.
  Sect. 4th. Table of equivalents and use of.
Part II. Description of chemical elements and their properties.
Part III. Dictionary of tests.
Part IV. The use of tests, and the practice of quantitative analysis of inorganic substances.
Part V. Description of apparatus.
Part VI. Chemical manipulation, and mode of operation generally.

(Signed) J. CAMPBELL, *Captain,*
Assistant Surveyor General.

Royacottah, 5th October, 1841.

Report of the death of Mr. Csoma de Koros, *made to* G. A. Bushby, Esq., *Officiating Secretary, Political Department, from* A. Campbell, Esq. *Superintendent, Darjeeling and communicated to the Society.*

It is with much regret that I report the death at this place, on the 11th instant, of Csoma de Körös, the Hungarian traveller and Thibetan scholar. He fell avictim to fever contracted on his journey hitherto, for the cure of which he would not be persuaded to take any medicines until it was too late to be of any avail.

Mr. De Körös arrived here on the 24th ultimo, and communicated to me his desire of proceeding to the residence of the Sikim Raja, and thence to Lassa, for the purpose of procuring access to stores of Thibetan literature, which he had been taught to believe, from his reading in Ladakh and Kănsun, were still extant in the capital of eastern Thibet, (Lassa,) and might have thence found their way into Sikim.

As the eldest son of the Sikim Raja is by the usage of the family a Lama, and as the present Tubgani Lama is a learned priest, and said to be in possession of an extensive library, I had some hopes that by making the Raja acquainted with M. De Körös' unobtrusive character, and known avoidance of political and religious subjects in his intercourse with the people of the countries he has visited, I might have contributed to procuring him permission to proceed into Thibet, and to this end I sent the Raja's Vakeel to visit M. De Körös, that he might satisfy himself as to the extent to which he had prosecuted his studies into the language and literature of Thibet, as well as of the objects he had in view in desiring to visit the Tubgani Lama and the city of Lassa. The Vakeel, who is a man of intelligence and some learning, was altogether amazed at finding a *Feringhee* a complete master of the colloquial language of Thibet, and so much his own superior in acquaintance with the religion and literature of that country. I endeavoured to answer his numerous questions about M. De Körös, by detailing the particulars of his early life and later travels in Asia with which I was acquainted; by stating his devotion to the prosecution of his lingual and literary studies; my certain knowledge that in permitting him to visit Sikim and Lassa, the Raja would have nothing to apprehend from ignorance of the usages and religion of the people, or an indiscreet zeal, in the attainment of his objects; that he was not at all connected with the service of our government, or any other power in India; but, that the Governor General had granted him his permission to travel through India, and that any facilities afforded him by the Raja, would be noted approvingly by His Lordship and myself.

The Vakeel at my desire addressed the Raja, explaining fully my wishes, and Mr. De Körös resolved to remain here pending a reply from Sikim. He was full of hope as to the favorable result of the reference, and in the most enthusiastic manner would dilate on the delight he expected to derive from coming in contact with some of the learned men of the East, (Lassa,) as the Lamas of Ladakh and Kānsun, with whom alone he had previous communion were confessedly inferior in learning to those of eastern Thibet. He was modest and almost silent on the benefits which might accrue to general knowledge from the results of his contemplated journey, but, " what would Hodgson, Turnour, and some of the philosophers of Europe, not give to be in my place when I get to Lassa," was a frequent exclamation of his during the conversations I had with him previous to his illness.

He had arranged, in the event of his getting permission to proceed, to leave with me all his books, papers, and bank notes to the amount of Rs. 300, to be cared for on his behalf; and a complete copy of the Journal of the Asiatic Society, which he had received from the Society. He said he should ask me to keep in the event of his never returning. How soon were all his enthusiastic anticipations clouded, and his journeyings stopped for ever!

On the 6th instant I called on him, and found him feverish, with foul tongue, dry skin, and headache; I urged him to take some medicine, but in vain. He said he had suffered often from fever and other ailments, from which he had recovered without physic, that rhubarb was the only thing of the sort he had ever used, except tartar emetic. The former had been recommended to him by Moorcroft, and the latter by a Persian doctor. He took out of his box a small bit of decayed rhubarb and a phial of tartar emetic, and said, with apparent distrust in their virtues, " As you wish it, I will take some to-morrow if I am not better, it is too late to-day, the sun is going down." I sent him some weak soup, and returned to see him on the 7th. He was then much better, got off his pallet, entered into conversation, chatted animatedly with me for an hour on his favourite subjects of thought and enquiry. For the first time since I had seen him, he this day shewed how sensitive he was to the applause of the world, as a reward to his labours and privations. He went over the whole of his travels in Thibet with fluent rapidity, and in noticing each stage of the result of his studies, he mentioned the distinguished notice that had been accorded in Europe and India to the facts and doctrines brought to light by him. He seemed especially gratified with an editorial article by Prof. Wilson, in the Supplement to the Government Gazette of 9th July, 1829, which he produced, and bid me read; it related to the extreme hardships he had undergone while at the monastery of Zemskar, where with the thermometer below zero for more than four months, he was precluded by the severity of the weather from stirring out of a room nine feet square; yet in this situation he read from morning till evening without a fire, the ground forming his bed, and the walls of the building his protection against the rigours of the climate, and still he collected and arranged forty thousand words of the language of Thibet, and nearly completed his Dictionary and Grammar. Passing from this subject, he said, in a playful mood, "I will shew you something very curious," and he produced another number of Wilson's paper of September 10th, 1827, and pointing to an editorial paragraph, desired me to read it first, and then hear the explanation. It run thus: (after noticing some communications to the Asiatic Society from Mr. Hodgson:) "In connexion with the literature and religion of Thibet, and indeed of the whole of the Bhoti countries, we are happy to learn, that the patronage of the Government has enabled the Hungarian traveller, Csoma De Körös to proceed to Upper Busahir to prosecute his Thibetan studies for three years, in which period he engages to prepare a comprehensive Grammar and Vocabulary of the language, with an account of the history and literature of the country. These objects are the more desirable, as we understand Mr. De Körös considers the recent labours of Klaproth and Remusat, with regard to the language and literature of Thibet as altogether erroneous. Mons. Remusat, indeed, admits the imperfectness of his materials, but Klaproth, as usual, pronounces *excathedra*, and treats the notion of any successful study of Thibetan by the English in India with ineffable contempt." "Now I do not recollect," said Mr. De Körös, "that I gave my opinion of Klaproth as it is given here, but oh! Wilson was very, very," and he shook his head significantly, "against Klaproth; and he took this opportunity to pull him down, and favour Remusat. It is very curious;" and he laughed heartily. Not being of the initiated in the curiosities of Thibetan literature, I did not fully appreciate the jest; but others probably will, and I was greatly interested with the keen enjoyment produced in the mind of the Ascetic, by this subject.

At the same visit, he produced "Hodgson's Illustrations of the Literature and Religion of the Buddhists," and asked me if I had seen it; on being told that I had a copy, and had been familiar with its contents in progress of collection, although unversed in the subject; he said, "He sent me this copy; it is a wonderful combination of knowledge on a new subject, with the deepest philosophical speculations, and will astonish the people of Europe; there are however some mistakes in it." I think he then said, "In your paper on the Limboos, you asked if the appellation 'Hung,' distinctive of families of that tribe, had any reference to the original 'Huns,' the objects of my search in Asia. It is a curious similarity, but your 'Hungs' are a small tribe, and the people who passed from Asia, as the progenitors of the Hungarians, were a great nation." I replied, that as the original country of the Limboo "Hungs" was undoubtedly north of the Himalaya, and as he believed the same to be the case as regarded the "Huns," it was at all events possible, that the "Hungs" of this neighbourhood, might have been an off-shoot from the same nation. "Yes, yes," he rejoined, "it is very possible, but I do not think it is the case." And then, as if preferring to luxuriate in remote speculations on his beloved subjects rather than in attempting to put an end to them by a discovery near at hand, he gave a rapid summary of the manner in which he believed his native land was possessed by the original "Huns," and his reasons for tracing them to Central or Eastern Asia. This was all done in the most enthusiastic strain, but the texture of the story was too complicated for me to take connected note of it. I gathered, however, from his conversation of this day, and of the previous ones since our acquaintance, that all his hopes of attaining the object of the long and laborious search, were centred in the discovery of the country of the "Yoogars." This land he believed to be to the east and north of Lassa and the province of Kham, and on the western confines of China; to reach it, was the goal of his most ardent wishes, and there he fully expected to find the tribes he had hitherto sought in vain. The foundation of his hopes, to any one not deeply imbued with enthusiasm, or accustomed to put faith in philological affinities, will probably appear vague and insecure. It was as follows, in so far as I could gather from his repeated conversations. In the dialects of Europe, the Sclavonic, Celtic, Saxon, and German, I believe, the people who gave their name to the country now called Hungary, were styled Hunger or Ungur, Oongar, or Yoongar; and in Arabic, Turkish, and Persian works, there are notices of a nation in Central Asia, resembling in many respects the people who come from the East into Hungary. In these languages, they are styled Oogur, Woogur, Voogur, or Yoogur, according to the pronunciation of the Persian letter, and from the same works it might be inferred, he said, that the country of the "Yoogurs" was situated as above noted. There were collateral reasons which led him to this conclusion, but he did not lay much stress on them, and they have escaped my memory. It has since occurred to me, that at the time of the conversations now detailed, Mr. De Körös had some presentiment that death was near him, for on no former occasion was he so communicative, nor did he express opinions, as if he was very anxious they should be remembered. On this day he certainly did so, and I feel it due to his memory to record them, even in this imperfect manner. To give his opinions point, it would require a knowledge of the subjects on which he discoursed, to which I cannot pretend; yet such as they are, they may, as the last words of an extraordinary man, be prized by those who honoured him for his acquirements, and admired him for his unwearied exertions in the cause of literature, languages, and history.

Although so much better on the 7th than on the previous day, I dreaded that a return of fever was impending, and I again urged him to take medicine, but in vain. On the 8th I did not see him, but on the morning of the 9th, on visiting him with Dr. Griffith, I found that fever had returned; he was confused, and slightly delirious; his countenance was sunken, anxious, and yellow, and altogether his state was bad and dangerous. After much trouble, we got him to swallow some medicine, and had his temples rubbed with blistering fluid. On the morning of the 10th he was somewhat better, but still unable to talk connectedly or distinctly; towards evening he became comatose, and continued so until 5 A. M. of the 11th, when he expired without a groan or struggle. On the 12th at 8 A. M. his remains were interred in the burial ground of this station. I read the funeral service over him, in the presence of almost all the gentlemen at the place.

The effects consisted of 4 boxes of books and papers, the suit of blue clothes which he always wore and in which he died, a few shirts and one cooking pot. His food was confined to tea, of which he was very fond, and plain boiled rice of which he ate very little. On a mat on the floor with a box of books on the four sides, he sat, ate, slept, and studied, never undressed at night, and rarely went out during the day. He never drank wine or spirit, or used tobacco or other stimulants.* * * *

Annexed is a detailed list of the contents of the boxes. Among his papers were found the bank notes for Rs. 300, to which he alluded before his death, and a memorandum regarding Government Paper for Rs. 5,000, which it is stated in transcript of a letter to the Government, dated 8th February, 1842, it was his wish to leave at his death to the Asiatic Society of Bengal for any literary purpose. Cash to the number of Rupees 224 of various coinage, and a waist belt containing 26 gold pieces, (Dutch ducats I believe,) completes the money part of his effects. From this I shall deduct the funeral expenses and wages due to his Lepcha servant, and retain the remainder, along with the books and papers, until I receive the orders of Government for disposing of them. As the deceased was not a British subject, I have not made the usual advertisement of the possession of his effects, nor have I taken charge of them in the Civil Court, but in my capacity of Political Officer in this direction.

From a letter of James Prinsep's among the papers, I gather that he was a native of the town of "Pest," or Pesth, in the province of Transylvania, and I have found transcript of a letter addressed by him to the Austrian Ambassador in London, apparently on matters connected with his native country; I presume therefore, that the proper mode of making his death known to his relations, if such there be, and of disposing

of the money not willed by him, will be through the Austrian Ambassador at the British Court. In some documents I found his address to be "Korasi Csoma Saudor."

I have the honor to be, &c.
(Signed) A. Campbell, *Superintendent.*

Note.—I may add to Mr. Campbell's interesting paper such confirmation as my memory enables me to give of the opinion held by the deceased philologist on the origin of the Huns, which with singular opinions on the Boodhist faith, constituted his most favourite speculations. He on more than one occasion entered on the subject with me at great length, detailing in particular the *Sanscrit* origin of existing names of places and hill ranges in Hungary: my constant request at the close of these conversations used to be, that he would record these speculations. He invariably refused, alluding darkly to the possibility of his, one day, having it in his power to publish to the world something sounder than speculation. In proportion as I pressed him on the subject, he became more reserved with me on these particular questions. He seemed to have an antipathy to his opinions being published. I remember his giving me one day a quantity of curious speculation on the derivation of geographical names in Central Asia. Some months afterwards, I had occasion to annotate on a theory of the nomenclature of the Oxus, and writing to him, recapitulated his opinion on the subject, and begged to be allowed to publish it by authority. His answer was, "that he did not remember." His exceeding diffidence on subjects on which he might have dictated to the learned world of Europe and Asia, was the most surprising trait in him. He was very deeply read in general literature, independently of his Thibetan lore; but never did such acquirements centre in one who made such modest use of them.

Note to accompany a Map of the Isle St. Martin's. *By* C. B. Greenlaw, Esq., *Secretary to the Marine Board.*

It is some time since the annexed map of a Survey of the Island of St. Martin's, south of the River Naaf on the Arracan Coast, has been prepared for publication in the Journal. It is by the late Mr. Frederick Bedford, who commanded a schooner employed on that Coast for the prevention of salt smuggling.

The survey of this and other islands and places on the Coast, formed no part of the established duties of Mr. Bedford's office, but he undertook them and executed them with a zeal and spirit that won for him the good opinion of his immediate superiors in the province, and with an ability which would assuredly have obtained him the future support and countenance of the Government, had he lived to carry on the further surveys which were in contemplation.

Unfortunately, however, the *Osprey*, the beautiful schooner which he commanded, was lost on the night of the 15th of November last in a gale of wind.*

The survey of St. Martin's Island, however, formed but a small portion of what he had already performed. He made a similar survey of Oyster Island, and of the mouth of the Myoo River, and his maps and charts formed part of a lengthened Report from the Commissioner of the province, Captain Bogle, on the propriety of establishing a regular chain of lights on the coast. I have no purpose, however, to go into that extensive question, although in connection with the increasing prosperity of the province, arising from its rapidly increasing growth and export of rice, as also with the consideration of the probable eventual establishment of a naval port at Kyouck Phyoo, it is an interesting, if not an important question.

My present remarks are necessarily confined to St. Martin's Island, and in addition to what is stated by Mr. Bedford in the sketch itself, in respect to the nature of the soil, I am enabled to add the following from the Commissioner, who says, I think justly, that this Island appears to be capable of being turned to profitable account.

Captain Bogle, after adverting to Mr. Bedford's remarks on the best position for a Light House, observes,

"It is not only as a light house station that this Island appears to be deserving of attention; as a Sanatarium for the people of Calcutta, it would I have no doubt be found invaluable; it cannot be at all subject to the evils of the climate of Arracan, for it is too far north, and is besides six miles from any land; it is about four miles long by one mile broad at the north end; it has plenty of excellent fresh water; turtle, and doubtless oysters abound; the sea around it supplies large quantities of the finest fish; the soil is in part excellent, probably well adapted to the growth of vegetables; it possesses some pretty undulating scenery, the northern portion of the Island being a perfect park; there is space for ten or twelve bungalows with compounds, as well as for Natives' houses. The beach affords a beautiful ride and splendid sea-bathing, and in the N. E. monsoon, the climate is superlatively fine, as it must also be in the months of March, April and May, when the sea breeze blows most refreshingly; in short, it is described as a very agreeable Island, and one which owing to its proximity to Calcutta, and its remoteness from external evils and temptations, might possibly be found a most admirable location, not only for the higher classes, but for European invalid soldiers."

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* It appears that the *Osprey* left the Naaf on the 15th of November, and has not since been heard of, but as a sudden and severe gale occurred during the night, there is no doubt she foundered. He himself had only on the 9th of the same month written, that she was as fine a craft as could be, and that he considered her equal to any service.

I can add nothing to this very interesting, though simple notice of Captain Bogle, beyond the expression of my hope, that some parties may be found sufficiently enterprizing to make trial of the capabilities of the Island, bearing in mind, that there is a regular established intercourse between Calcutta and Arracan by means of the *Amherst*, and that therefore there would always be periodical opportunities of coming and going; add to which, it is to be hoped, that another vessel will shortly be sent to take the place of the ill-fated *Osprey*, which by her visits would help to enliven the place, and add to the means of communication.

On the Cotton called "Nurma," by Dr. IRVINE, *Residency Surgeon at Gwalior. Communicated by* COLONEL SPIERS, *Resident at that Court.*

I have the honour to forward to you the result of my inquiries regarding the Nurma cotton, which I have only now been able to complete. I send the information I have obtained in the form of question and answer.

I beg to call your attention to the fact, that Nurma is the name applied to this cotton by the Mussulmans only; and that the real name from time immemorial is "*Burari,*" and that it is in all probability indigenous. The Nurma is not produced as a crop at Chanderee, but is imported as required from Cholai Muhasur on the Nerbudda, where it is regularly cultivated.

A few years since, an experiment was tried at Chanderee of growing the Nurma cotton, but as the cotton yielded was not so good as that imported, and as insects and frost injured the plants, and as the cotton adhered very firmly to the seed, the ryots at once gave up their intention of cultivating the Nurma plant. This abandonment seems to have been very premature; as it is most likely that a little more care and perseverance would have insured success. The present demand for Nurma cotton is, however, so very small, the trade in fine Mamoodies being little or none, that no encouragement is afforded to the cultivators. The present supply of Nurma cotton from Cholai Muhasur at Chanderee has been five years in the godowns there, and is far from exhausted, and can be had there at three seers per Chanderee rupee.

It will be observed, that the Nurma cotton is naturally of a dirty yellowish colour; it is also gathered very carelessly; the wool adheres strongly to the seed; and the fibre though fine, is not long in the staple. It is vastly inferior to Sea Island cotton in every respect.

I take the liberty of sending another specimen of common American cotton grown by me at Gwalior last rains. This cotton, it will be seen, is finer, and in every respect better than the Nurma cotton; the Chanderee people themselves say so, and this common American cotton can easily, under proper treatment, be introduced into India. The Nurma cotton can no doubt be spread over the country in suitable places; but it will never equal the American cotton. The fineness of spinning is no criterion, as the invisible thread of Chanderee has been far surpassed by the Manchester machine spinning, where one pound of the best cotton has been extended to 8 skeins of 180 yards each, but this degree of fineness is not a desideratum in England, and has been effected only as a curiosity.

The labour, delay, and expense of the Chanderee Mamoodie manufacture of any degree of fineness is exceedingly great. The finest Mamoodie piece of five yards costs Chanderee rupees 100; the breadth being only half a yard, while for this sum ten pieces of fine Scotch Cambric can be purchased even up-the-country of beautiful even texture, 7 yards long and a yard wide.

The greatest trouble and time is taken in collecting skeins from the different spinners of equal fineness.

1*st Query.*—What is the kind of cotton called Nurma; is it of this country or foreign; and if foreign, in what way has it been introduced; who brought the seed first, and from what country?

1*st Answer.*—Nurma cotton is foreign according to universal belief at Chanderee; has always been brought to Chanderee from Cholai Mahasur beyond Kidore on the Nerbudda; the best Nurma cotton is alone brought from that place. The Cholai Muhasur seed has on one occasion been sown at Chanderee as an experiment, and though the cotton produced was fine, it was not at all equal to the real Nurma cotton of Cholai Muhasur. The inhabitants of Chanderee have no idea of the time of the introduction of Nurma cotton into India. For the last 25 years, the present fineness of thread has been spun; formerly the thread spun was so very fine as to require a blanket on the ground moistened to receive it as it came from the wheel, when the thread was scarcely visible; and it is said, that a skein placed loosely in a saucer of water, might have been drank unknown to the person swallowing it. Mussulmans and Hindoos of all classes equally employ themselves in spinning this cotton. Nurma is the name given by the Mussulmans; the real name from time immemorial is "*Burari,*" which would indicate Berar as the original country of this cotton; or the word may have arisen from the cotton drawing easily out into a thread, from "*burana,*" to draw out.

2nd Query.—Is Nurma cotton produced in the common fields, or does it require peculiar ground and treatment?

2nd Answer.—Nurma cotton has always been imported into Chanderee, and has only once been sown there about five years ago. The Nurma seed was sown at the villages of Keerawul and Sersode, four miles from Chanderee; the cotton produced was not so good as that of Cholai Muhasur, the crop was besides injured by insects, the ryots therefore did not sow it again. It appears, however, evident, that the Nurma cotton would succeed about Chanderee, but there being very little demand, there is no encouragement. At present Cholai Muhasur supplies amply more than is required at Chanderee. As stated, three beegahs were sown at Keerawul, and two beegahs at Sersode, and the cotton produced, though fine, was like common country cotton in adhering firmly to seed, and hence was rejected by the spinners. The soils at these villages are light brown loams. In these native experiments, the Nurma seed was sown in the same way as the common country cotton. After the first rain in June, the ground was ploughed, then allowed to imbibe a heavy shower, the seed was then sown, then harrowed with the wooden "*putela,*" then exposed to a few days' rain, after which the young plants were weeded by the hand, the ground was then hoed, after which common manure was spread over the field by the hand amongst the plants, the weeding and hoeing were repeated at intervals several times. The crop was nearly destroyed by small insects, and by frost. The Nurma cotton produced at these villages on this occasion, required the seed to be separated from the cotton by the *churkee,* or rollers; while the seed of real Nurma cotton from Cholai Muhasur is easily and immediately separated from the seed, merely by rolling it lightly with a wooden pin, or by picking it with the hand.

3rd Query.—Do the natives largely manure the fields for Nurma cotton; and is a peculiar manure used?

3rd Answer.—This I have written to inquire at Cholai Muhasur.

4th Query.—At what season is Nurma cotton sown, and in what manner; when is the crop ready, and after gathering, how is it cleaned?

4th Answer.—After the first fall of rain in June, in the same method as country cotton. The crop is gathered about October or November at seven or eight intervals, according to the favourableness of the season, and is cleaned by the hand, or a small wooden rolling pin. The cleaning is evidently very much neglected, as the Nurma cotton is brought from Cholai Muhasur in the same dirty state as the specimen sent. Before spinning, the Nurma cotton is pulled out for six hours by the fingers, and then is drawn out and dusted by a small apparatus, (or "*pinjurs,*") of a catgut thread struck by a mallet, and is then rolled on small sticks, from which it is placed in paper sheaths to spin off, each sheath having a leather wrapper to give a firm hold, and also to prevent the perspiration soiling the contained cotton. It is spun by very small wheel, having a very fine spindle.

5th Query.—What is the price of the best Nurma cotton, and to what country is it exported?

5th Answer.—Formerly as there was a great demand at Chanderee, and as the supply from Cholai Muhasur was in a degree limited, the Nurma cotton cost Chanderee rupee 1 per seer; now the demand has so greatly fallen off, that three seers can be had for the same sum. This cotton is alone imported to Chanderee from Cholai Muhasur; it is not known to be imported into any other place; for several years Nurma cotton has not even been brought to Chanderee; the finer cotton Mamoodies being in very little demand, the trade has vastly diminished. Rich natives only make inquiries for this fine cloth, which is sold in a very few shops. The Nurma cotton of which these Mamoodies are now made, has been in the Chanderee godowns for five or six years past, and does not spoil by keeping.

6th Query.—How many years does the Nurma cotton remain in the soil?

6th Answer.—One year only.

7th Query.—What soils are deemed the best for the Nurma cotton? Specimens of the soils are required.

7th Answer.—The light brown loams are deemed the best cotton soils. The Sersode soil is only sent; one specimen from the surface; one from 8 inches deep; one from 1½ feet deep.

8th Query.—The nature of the soils and minerals around the cotton fields?

8th Answer.—These specimens for reasons stated have not been brought.

9th Query.—Are the Nurma cotton fields watered or not; and if watered, how often?

9th Answer.—They are never watered, being left solely dependent on the rains.

10th Query.—When the Nurma cotton plants are about to flower, are the tops broken off or not?

10th Answer.—The plants are always left in their native luxuriance.

11th Query.—A specimen of Nurma cotton is required.

11th Answer.—The specimen of Nurma cotton is one imported at Chanderee from Cholai Muhasur; there is also a specimen of the deteriorated Nurma cotton from seed, as stated, sown at Chanderee.

12th Query.—When the Nurma crop is ripening, is the plant liable to disease?

12th Answer.—The Nurma plants produced at Chanderee were much injured by insects and by frost. The insects were like those moths that destroy woollen cloths.

13th Query.—When the fields of Nurma cotton produce plentiful crops, what tax is paid per beegah?

13th Answer.—From eight annas to one rupee a beegah, as for other crops.

14th Query.—At Chanderee how deep are the wells, and in what stratum is water found?

14th Answer.—About forty cubits deep the water is found in sandstone: the water is excellent.

15th Query.—Specimens of the thread of which the fine Mamoodies are made are required?

15th Answer.—Two skeins or "*pucheries*" of the thread are sent, the finest weighs 2¼ mashas, and costs 4 annas; the coarser weighs 2¾ mashas, and costs 3½ annas; one of these "*pucheries*" cannot be spun in less than four days. They are spun by all parties, and when collected, are arranged according to their fineness.

GWALIOR, *March* 17, 1842.

NOTE.—My readers may recollect, that " Nurma" cotton from the neighbourhood of Herat, was one of the samples of the staples of trade between Sinde and Khorasan, and that "the foreign origin" of the Nurma grown in Bundelkhund was then accounted for by me by the natural supposition, that the fine cotton was brought into the country by the early Mussulman invaders; an opinion which I still adhere to.

On a Cylinder and certain Gems, collected in the neighbourhood of Herat by Major Pottinger. By the EDITOR.

I have selected the gems figured in the annexed plate from among a collection placed in my hands by Major Pottinger. The cylinder (Fig. 1,) is a very curious relic indeed. It was found on the hills close to Herat by an Eimauk woman, from whom, I believe, Major Pottinger purchased it. The material of which it is composed, as well as the figures, and Cuneiform characters upon it, having equally baffled conjecture and ordinary investigation, I sent the impression, taken in sealing-wax, to Major Rawlinson at Candahar, requesting him, acquainted as he is with some of the forms of the Cuneiform character, to give me his opinion upon it; while I applied to my friend, Mr. Piddington, now Curator of the Geological branch of the Museum of the Asiatic Society, to determine, if possible, the material of which the cylinder was composed. His opinion, in which Professor O'Shaughnessy concurred, was given me as follows:—

" At the request of our Secretary, I have examined this precious relic as to its physical properties. Its dimensions are,

	Inches.
Height, ...	1.1
Diameter, ...	0.5
Diameter of the hole,	0.2

"The hole is not drilled through the exact centre, and, as may be seen by looking into it, has been drilled from opposite ends. Its hardness is very considerable, as a good file will scarcely touch it. It is magnetic, but not strongly so, and its spec. grav. by two trials at a temperature of 82° is 4.97. Neither nitric nor muriatic acids produce any effect on its surface. Its colour is a dark black grey, with minute shining specks, (probably of magnetic oxide of iron or mica,) only seen in a strong light, or by a magnifier.

"As it is by far too valuable to take even the minutest portion for a blowpipe analysis, I am deprived of any farther means of ascertaining what it can be. Its high specific gravity places it far out of the class of basalts, to which it would at first be referred on a cursory inspection; and its hardness out of the magnetic iron ores. I am inclined to think it a ferruginous titanite, analogous to that described by Klaproth from Aschaffenbourg, in Silesia. Perhaps, though not exactly a physical property, I should not omit to remark the admirable sharpness of the characters, which it is doubtful any metallic tool could have produced.

"I add here from the London translation of 1801 of Klaproth's Essays, p. 504, the chemical characters of his fossil :—

'*Colour.*—Iron black, accompanied outwardly by a moderate, inwardly by a stonger, metallic lustre.

'*Fracture.*—Uneven and of a fine grain; fragments indeterminately angular.

'*Hardness.*—Very brittle and hard, and only with difficulty ground to a subtle powder, which is black.

'*Specific Gravity,* 4.74.—(This was probably at 60°.)

'*Magnetism.*—Not attracted by the magnet even in the small splinters, nor does it attract the least particle of iron. The more remarkable is it, therefore, that it attracts and repels the poles of the magnetic needle, or any moveable magnetic bar.

'*Composition.*—Oxyde of Iron, 78. Oxyde of Titanium, 22=100.'

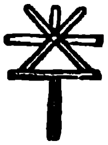
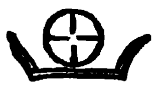
"So far Klaproth. I may add, that the degree of magnetism which he here describes, is that which our cylinder also possesses, and which is now well known to be merely an inferior degree of the same element."

The character Major Rawlinson informs me, is the third, or mixed order of the Cuneiform writing. He supposes the inscription to express some formula of prayer, or adjuration. The cylinder being evidently an amulet to be worn suspended round the neck, or the arm, or perhaps on a string round the middle, as with the amulets of a somewhat similar shape worn by children in this country, his conjecture is in all probability correct. The figures and emblems on the cylinder have yet to be explained. The man holding a dagger, is perhaps in the act of binding himself to some compact, religious or civil, the conditions of which are expressed in the inscription in the presence of a priest, some emblem having reference to the rite, being apparently the image of a bird, being set up between the two? Or is the supposed priest in the long striped robe a female figure? I have taken much pains to arrive at even a plausible conjecture respecting the upright emblem, as a clue would be readily found to the meaning of the whole, could this type be traced. All I can say on the subject is, that such an emblem is figured in Rich's Memoir on the Ruins of Babylon, in No. 1. *a.* of the plates which illustrate that interesting notice. "No. 1," says Mr. Rich, "is a black stone of an irregular shape (in part broken and defaced,) about one foot in length, and 7½ inches in breadth. The figures on it *a* and *b*, have been supposed to represent the Zodiac of the Babylonians;" an inscription is partly legible, I should observe, on the stone, written in the first form of Cuneiform writing. The figures on the stone *(a)* are those of a dog, or wolf, and *of a bird seated upon a staff or rest, set upright in the ground.* The shape and attitude of the bird would incline one to conclude that the artist intended to represent a crow or raven. The idea that the emblem is Zodiacal, is, I think, borne out by the nature of the figures on *(b)*, the other part of the same stone, which represent an antelope, a human head with ram's horns, an altar, two human figures, and others which are indistinct. I am more impressed with the theory of the Zodiacal character of the *bird* emblem, from having found it with other similar figures, in a plate Vol. II. of Kerr Porter's Travels.

I have by me drawings by the late Edward Conolly of several similar rude figures of birds, of which he gave me the following notice: "These are from Seistan; these small copper images are however found in the ruins of old cities in all parts of this country, and have been dug out of topes." Mr. Rich observes, "small figures of brass or copper are also found at Babylon:" (?) of a similar description with the above. (?)

This suffices to establish the fact, that such an image as that figured on the cylinder, was for some purpose as yet unknown to us, but having reference, probably, to a religious rite, in common use among the ancient

Parthian (?) inhabitants or invaders of Khorassan. Even this meagre index to a solution of the meaning of the type might give an able antiquary the means of following up the investigation with success.

The cylinder, figured No. 12, in Rich's Memoir of the Ruins of Babylon, differs from that before us as respects the inscription, but with regard to the human figures, is precisely the same. The priest in the striped robe, with his arms raised in the manner (vide Kerr Porter's Travels,) depicted on many of the ancient Persepolitan sculptures, the man with the dagger, as if in the performance of a rite, are exact in the one as in the other; the emblem between these figures is however different from our's; it is also differently placed, and not as standing on the ground; it is in  this shape, while the indistinct emblem, which is given in our's above the heads of the figures, is replaced in Rich's by a directly solar type, as I conceive it to be.  This variation in the emblems may account for the inscription of a different written formula. Mr. Rich's brief notice of these curious relics, I extract for readier reference.

"The Babylonian cylinders are among the most remarkable and interesting of the antiques. They are from one to three inches in length: some are of stone, and others apparently of paste, or composition of various kinds. Sculptures from several of these cylinders have been published in different works; and Nos. 10, 11, 12, 13, and 14, are specimens of my own collection. Some of them have Cuneiform writing on them, (as Nos. 12 and 13,) which is of the third species; but has the remarkable peculiarity, that it is reversed, or written from right to left; every other kind of Cuneiform writing being incontestably to be read from left to right. This can only be accounted for, by supposing, that they were intended to roll off impressions. The cylinder No. 11, was found in the site of Ninevah. I must not omit mentioning in this place, that a Babylon cylinder was not long ago found in digging in the field of Marathon, and is now in the possession of Mr. Fauvel of Athens. The cylinders are said to be chiefly found in the ruins of Jerbouiya. The people of this country are fond of using them as amulets, and the Persian pilgrims, who come to the shrines of Ali and Hossein, frequently carry back with them some of these curiosities."

Having done my best to offer some explanation of this curious relic, I have, *with inexpressible regret* to state, that it is no longer in my possession; a friend to whom I entrusted it, for the purpose of examination, having mislaid, or lost it.

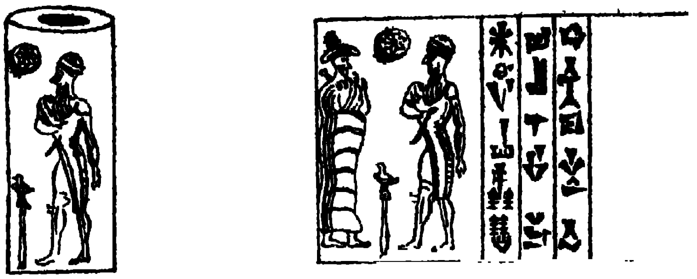
My readers will at once detect on Fig. 2, characters similar to those of Conolly's gem of *the hand and ear,* noticed by me in No. 122 of the *Journal,* and of other gems already published in this Journal. They are boldly and elegantly cut, as are also the wild goat's head, and the palm leaves (?) which complete the device. The gem is on basalt, which has been cut down to form a surface for the execution of the carving. The whole has then been roughly polished, and the stone drilled, to allow of a string or ribbon being passed through it. The perforation so made, is about a third of an inch in diameter, and is cut in a clean and workmanlike manner. Its large size, compared with that of the gem itself, is perhaps indicative of the value attached to the amulet, its wearer being desirous of securing it by as strong and thick a ligature as possible? I conjecture the device to have some planetary allusion. Might one suppose it zodaical, and detect Capricorn in the goat's head? It is given in its full size in the plate, but without a side view, which would have shewn the perforation, and the whole bulk of the gem.

No. 3.—Is on crystal, the head Sassanian; a variation of the characters (?) the execution good.

No. 4.—Red cornelian, a man driving before him a humped bull. The characters are indistinct, and the execution coarse: the reverse of the gem plain and highly polished.

No. 5.—Sardonyx, the characters similar to those of No. 2, and beautifully executed. I fail, however, entirely to make out what the central object is intended for; a conch shell? This stone by its shape and size, appears to have been intended for a seal ring.

No. 6.—Red cornelian, it is carved on both obverse and reverse, and carefully polished: the former slightly convex, the latter flat. The character is evidently the ancient form, used for the earliest Pali inscriptions. My Pundit, Sarodha Prasad, professes to read the reverse in Pali, **मह्वामहिमगसमादेश** which rendering Pundit Kamala Kanta concurs in. The obverse is perhaps the abbreviated form of some ordinary mandate, as the characters appear arbitrary, and the meaning of the reverse, (as read by the Pundits,) *maha mohe maga samadesh,* carries out the inference, it being, "command of him who is first in dignity." (?) I give the



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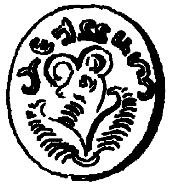

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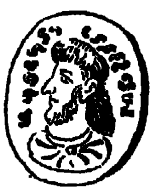

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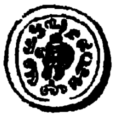

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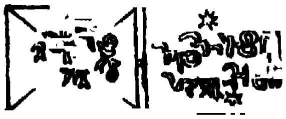

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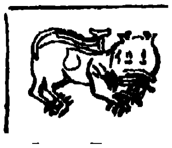

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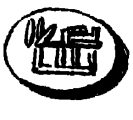

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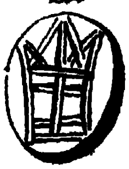

reading *(quantum valeat)* on their single authority. If it is a correct one, we have before us the signet of some bye-gone potentate, who used it to authenticate his written orders.

In the numbers which follow, I have given specimens of the ruder and un*lettered* gems found in numbers in Khorassan, as in the upper part of the plate are shewn various descriptions of *lettered* gems from the same quarter, giving inscriptions in *three,* if not *four,* of the forgotten languages of the earth.

No. 7.—Pink cornelian : it is roughly polished, and drilled for threading. The subject, a stag with branching antlers, is perhaps the commonest among the devices on such gems. Nos. 10, 14, 17, and 22 give proof of it. A solar type is perhaps intended.

No. 8.—Red cornelian : a lion very coarsely cut, the stone however is carefully shaped and polished.

No. 9.—Crystal : the subject (?)

No. 10.—Fine red cornelian, highly polished; apparently a flower.

No. 12.—Red cornelian : a humped bull; this stone is rudely perforated.

No. 13.—Crystal : a horse rudely cut on the convex side of the stone.

No. 14.—Pink cornelian.

No. 15.—Ditto, the stone rudely perforated : the subject (?)

No. 16.—Ditto : a bull.

No. 17.—Veined brownish cornelian : the stone has been ground down to form a surface, and is roughly perforated.

No. 18.—Serpentine : a mounted horseman.

No. 19.—Crystal.

Nos. 20, 21, 22, 23.—Red cornelian : all these gems are merely given as specimens of the rude emblematic devices found in numbers about the sites of ancient cities in Khorassan.

No. 24.—Is a lump of white agate, rudely ground down in one place for the reception of the device, and as rudely perforated. A *Jotee,* or Jain priest, who saw this gem, professed to recognize a Budhist emblem in it, declaring it to be the conventional mode of representing the *sruthi sthaponi,* or desk-frame from which the Budhist scripture is read : he brought me an ancient Pali illuminated inscription to prove his assertion, by pointing out to me a similar device; but by no means succeeded in convincing me of the resemblance. The supposition is however perhaps worth mentioning.

Museum of Economic Geology of India. *By* H. PIDDINGTON, ESQ.

SIR,

I am authorised by the Committee of Papers of the Asiatic Society, to forward to you the accompanying Memorandum relative to the MUSEUM OF ECONOMIC GEOLOGY OF INDIA now forming, in the confident hope that you will personally, and through your friends, kindly assist their views and those of Government, as far as lies in your power.

With respect to carriage of Specimens, such small ones as may not exceed the usual dawk banghy weight, say 500 Tolas, may be sent at once, addressed to the Secretary of the Asiatic Society, and those above that weight dispatched by the nearest water carriage, preferring the Steamers if obtainable. I am, Sir,

Your obedient Servant,
H. PIDDINGTON,
Curator, Mus. Econ. Geology of India.

CALCUTTA, 184 .

The objects of the Museum of Economic Geology of India, which has been established by Government at Calcutta, under orders from the Hon'ble the Court of Directors, in conjunction with the Asiatic Society and at its Rooms, are the following: They are, as scientific men will perceive, generally those of Economic Geologists in all countries, but there are some peculiarities connected with India, and the situations of Europeans in it, which will oblige us to go into a little detail, to explain to those who may not already take an interest in these matters, our wants, our wishes, and our hopes of the advantages which may accrue to the community from this new establishment. Its objects then are briefly these:—

1. To obtain the most complete Geological, Mineralogical, and Statistical knowledge possible of all the mineral resources of India, wrought or unwrought, so as to make them as publicly known as possible; to shew how they have been, or are now wrought, or how they might be so to the best advantage.

2. To obtain a complete set of specimens, models, and drawings, relative to the Mining operations, Metallurgical processes, and Mineral manufactures of all kinds, of India and of Europe and America; so as to afford to the public information of every thing which can be turned to account here or in Europe, and perhaps prevent loss of time, waste of capital, and disappointment to the Indian speculator.

3. To furnish the Engineer and Architect with a complete collection of all the materials, natural or artificial, which are now, or have formerly been used for buildings, cements, roads, &c. and of all which *may* possibly be useful in this department, whether European or Indian.

4. To collect for the Agriculturalist, specimens of all kinds of soils remarkable for their good or bad qualities, with the subsoil, subjacent rocks, &c. and by examination of these, to indicate their various peculiarities and the remedies for their defects.

5. To collect for Medical men, the waters of mineral springs, mineral drugs, &c. &c.

6. And finally, by chemical examinations of all these various specimens, to determine their value, and how they may be best turned to account for the general benefit of the community.

With objects like these the Museum of Economic Geology may be said to be placed between the purely scientific geologist and the merchant, the miner, the farmer, the manufacturer, and the builder, or in other words, the merely practical men, who may desire to know how the knowledge of the geologist and mineralogist,—to them often so recondite, and apparently so useless,—can forward their views: and its office, to be, if possible, to answer all questions of this nature which may arise, for public benefit.

This may sometimes to be done from books, but the great library must be the collections of our Museum, which are in fact a library of examples, to which the commentary is the laboratory; where, aided by the resources of the collection, questions may often be solved in an hour, a day, or a week, which it would take half an *Indian* life to obtain the mere materials for investigating. An extensive collection, then, is the first requisite, and this should, if possible, comprise every inorganic product of the earth from which mankind derive any advantage, with every information relative to it. It will readily occur to the reader, that in India, owing to her infancy in some of the arts dependant on these products, as in mining, agriculture, &c.; and her singular progress in others, as in peculiar branches of Metallurgy and the like, our almost absolute ignorance of what her methods and resources are, the peculiarities of situation in which these resources may exist, those of climate, workmen, and many others, we have almost every thing yet to learn; and that to accomplish our objects, we cannot be too well furnished with all the knowledge and examples of Europe and the Americas, and all those of India, or of Asia. Without these, our progress must be very limited; but in proportion as we obtain them, we may hope, without presumption, to see the day when the mines, the quarries, and the soil of India may be done justice to, which assuredly, has never yet been the case.* In this all classes are so clearly interested, that it would be superfluous to shew it, as it is to shew that the resources of every country are far more readily developed with public means for investigating, preserving, and publishing all knowledge belonging to them, than where none such exist.

It is therefore hoped, that those who may be desirous of assisting this great public work, will bear in mind, that nothing, however familiar it may be to those on the spot, is indifferent to us; for *if not wanted for the institution, it may serve to procure that which is;* and the following note is given rather as a general memorandum than as specifying all which is desired. The general rule is, that details cannot be too numerous, nor specimens too various, particularly if purely Indian.

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* It is curious to find that upwards of 140 years ago, the ores of the precious metals were an article of export from the Dutch East Indies! This is clearly shewn by the following passage from Schlutter's work, as translated by Hellot, and published by him under the title of "Hellot sur les Mines," Paris, 1753. In Vol II. p. 285, Chap. XLVI. "*On East Indian Ores and their Fusion by the curved Furnace,*" he says—

"In 1704, Schlutter received by a private channel twenty-five quintals of ore from the East Indies, &c." And again: "These sorts of ores (of gold and silver) sent from India by the Dutch were frequently smelted at the foundery of Altenau in the Upper Hartz, but had never been smelted in the Lower Hartz. This ore was in lumps from the size of a nut to that of walnut, and by trials it was found that the quintal of 110lbs. contained 1 oz. 8 drs of gold and 3¼ oz. of silver."

DESIDERATA FOR THE MUSEUM OF ECONOMIC GEOLOGY OF INDIA.

I.

MINES AND MINING PRODUCTS.

1. Specimens of all crude ores, just as found. If possible also, of the rocks or matrix in which found; of those indicating the vein at the surface; of the walls of the veins; of the strata or beds passed through before reaching them; and of the rocks of the surrounding country.

2. The ores after preparation for the furnace by picking, washing, stamping, roasting, &c.

3. The rejected ores, gravel or stones found with those used; which often go under odd names, as those of "mother, devil," or the like.

4. The fluxes used, if any.

5. Memorandum of the kind of fuel used, samples of it if coal or coke, &c.; names of the trees, as bamboo, &c. if charcoal; and if not too far, send specimens.

6. The roasted or half smelted ore.

7. The pure metals, as obtained in a merchantable state, of all the qualities.

8. The slags, of all kinds, from the furnaces and smeltings.

9. Drawings or models (to scale of possible) of all furnaces, machinery, and implements used in any of the processes, with drawings, plans, and models of the mine. Earthen models of the furnaces, &c. may often be well made, by the native image makers for a mere trifle.

10. Specimens of any tools used.

11. Traditions, history, and statistics of the mine or mineral products, as (1.) How and when found; (2.) Produce, gross and net; (3.) Rent if farmed, or what tax payable on the product; (4.) Price of daily labour; (5.) Amount of labour obtainable for a given price; (6.) Estimated profits, past and present; (7.) Reasons for decay or increase; (8.) What is now required to make the mine more productive; (9.) Copies or notices of any books or accounts of the mine; (10.) Health, comfort, morals, and condition of the workmen employed, average of ages, and of life among them if thought unhealthy; seasons and hours of work. Superstitious notions, peculiar diseases, &c. &c.

II.

BUILDINGS, CEMENTS, POTTERY, COLOURS, ROADS, &c.

1. Specimens from the quarries, of all kinds of building stones, useful or merely ornamental.

2. The same of limestones, shells, corals or other articles, used to make lime or cements of all kinds.

3. Specimens of the strata above and below the quarried stone.

4. Any fossil shells, bones, fish, plants, insects, or other appearances of organic remains large or small, found in or near the quarries, or amongst the rubbish and water-courses of quarried spots. If specimens appear too large to move, please to give a notice, with an eye-sketch, and estimate of the expence of moving, and preserve it till a reply is sent.

5. Specimens of the building stones or remarkable bricks used in any public edifices, monuments or tombs, with the date of their erection if known, and a note to say if exposed to weather or protected by stucco, paint, or roofs.

6. Memoranda and specimens of any plants or animals destructive to masonry, as boring worms and shells in water, and the like, with specimens of their work.

7. Ornamental or stucco-work: specimens of it, new or old, interior or exterior, with the best account procurable of the materials, preparations, and working of them.

8. Specimens of stones and marbles, shells, &c. used for image or ornament-making; of earths for pottery, and varnishes of coloured earths of all sorts, whether used as pigments or not.

9. Specimens of peculiarly good materials used for roads, whether ancient or modern, with prices, methods of using them, and other Memoranda.

10. Prices of all the above; rates of labour, carriage, &c. from the rough to the wrought state, and all other statistical details as in the case of Mines and Mineral products above mentioned.

III.

AGRICULTURAL GEOLOGY.

1. Specimens of soils of good, and the best qualities, for all kinds of produce, as sugar, cotton, tobacco, &c.

2. Of infertile soils or veins of earth.

3. Of the subsoil or rock.

4. Of the stones scattered about these soils.

5. Memoranda relative to the height of these soils above the water of wells in the rains and dry season, and of its drainage, shelter, exposition, &c.

6. Of any kind of earths, mud, or stones used as manures, as peats from the jheels, kunkurs, &c.

7. Of the deposits (fertile and infertile) left either by the common inundations or by violent floods, with memoranda of their effects on the cultivated soil.

8. Specimens from any separate spots, where gravel or stones are collected in quantities after inundations or floods.

9. Accounts of remarkable floods, and average heights of the rise of rivers, of the raising of the soil, alterations in its produce consequent thereupon, and all other details.

10. Memoranda relative to the formation or destruction of river-banks, islands, &c. with measurement if obtainable.

11. Samples of all kinds of efflorescent salt-earths, with specimens of the different salts prepared from them, prices of preparation, selling rates, and accounts of the processes and uses of the salts.

12. Specimens of brine springs, with details of manufacture if boiled for salt, and statistics of labour and produce, &c. as in the case of mines.

IV.

MEDICAL GEOLOGY.

1. Specimens of mineral medicines of all sorts, whether produced on the spot or imported, crude and prepared, with notes and samples of the process of preparation in all its stages.

2. Of the water of mineral springs, their temperature, incrustations about them, account of their uses, and specimens of the rocks or soil in which found.

V.

NATIVE METALLURGICAL PROCESSES, OR MINERAL MANUFACTURES.

1. Exact descriptions of them, however rude or simple they may appear, with samples of the ores, fuel, fluxes, products, slags, &c.

2. Models or drawings (to scale if possible) of the furnaces and implements of all kinds; specimens of these last may be sent.

3. Memoranda and samples of the earths or sands used for moulds in castings, of the crucibles and beds, raw and baked, and of the raw material from which made.

4. Prices of raw and wrought materials.

5. Drawings of machinery used for turning, boring, polishing, &c.

In conclusion: It is not supposed that any individual, unless wholly devoted to the research, can supply the whole of the desired specimens, or even of the knowledge relative to any one product; but any *single* item of the foregoing may be of importance, at sometime, to some one; and it will be the special duty of the Asiatic Society, and of the Curator of the Museum, to see justice done to every contribution; whether relating to the Geology of India in general, or to this peculiar branch of it.

H. PIDDINGTON,
Curator, Museum Economic Geology.

Correspondence respecting the Society's Museum of Economic Geology.

NOTE.—The institution of our Museum of Economic Geology is necessarily of such interest, that the publication of the Correspondence having reference to it, and to the appointment of a joint Curator, will be read with satisfaction by many of my readers.

To H. TORRENS, ESQ. *Secretary to the Asiatic Society.*

SIR,—In continuation of my letter, No. 433, dated the 24th March last, on the subject of the formation of a Museum of Economic Geology in India, I am directed by the Right Honorable the Governor to transmit, for the information of the Asiatic Society, Extract Paragraphs 2d and 3d of a despatch from the Honorable the Court of Directors, No. 13 of 1841, dated the 8th September, and to invite the Society's particular notice to the requisition therein contained, with a view to its being complied with whenever practicable.

2.—I have been further desired, in connection with the 2nd paragraph of my letter dated the 14th April last, to enclose for the Society's information, copy of a circular addressed by the Military Board to the

Superintending Engineers, forwarding a copy of Captain Tremenheere's Memoir, agreeably to Mr. Piddington's suggestion.

I have, &c. &c.

G. A. Bushby,

Secretary to the Government of Bengal.

Fort William, *the* 1*st December*, 1841.

Extract from letter No. 13 *of* 1841, *from the Honorable the Court of Directors, in the Revenue Department, under date the* 8*th September.*

2.—We have transmitted a copy of Mr. Piddington's Report to Mr. Delabeche, the Director of the Museum of Economic Geology in this country, and we have informed that gentleman, that we shall be happy to receive from him for transmission to you, any communication which he may desire to make on the subject of that Report, as well as any further specimens which it may be in his power to add to the collection.

3.—We desire that you will transmit to us any specimens which you may be enabled to collect of objects, which in your opinion may be appropriately presented to the Institution over which Mr. Delabeche presides.

(A true Extract,)

G. A. Bushby,

Secretary to the Government of Bengal.

Circular No. 31.

To the Superintending Engineers.

I am instructed by the Military Board to send for circulation to the Officers of Public Works under your control, the copy of Mr. Secretary Bushby's letter No. 432 of 24th March last, and copies of a Memorandum drawn up by Captain Tremenheere, regarding the establishment in Calcutta of a Museum of Economic Geology, and to request that you will invite the co-operation of the Executive Officers of your circle in the attainment of the proposed end.

2.—The Memoir contains full instructions as to the manner in which the co-operation of officers may be best effected. It shews what specimens should be collected, and what information should accompany them.

3.—The Board desire me to express their hope, that officers will turn their attention to the objects contemplated in the formation of the proposed Museum, and they desire me to request, that when any box of specimens is collected the circumstance may be reported to you, and your orders taken as to its transmission before any actual expense is incurred. A copy of the descriptive papers which are to accompany the box should also be sent to you, in order, that if the information appears deficient in any essential point, you may have the deficiency supplied before the specimens are actually sent to Calcutta.

4.—The Board would wish you to exercise your discretion as to having the boxes sent in the first instance to your own office and thence transmitted to Calcutta, or in desiring Executive Officers to send the specimens direct to the Presidency; but in either case, they should be sent to the Board's office for transmission to Government.

5.—The Board request particular attention to the 2d paragraph of Mr. Bushby's letter, but they do not conceive it to be the intention of Government, that useful specimens should be entirely withheld, when opportunities of sending them free of expense do not occur. The Board trust, however, that the most economical mode of transmission will always be adopted.

I have, &c.,
(Signed) A. Broome,
Officiating Secretary Military Board.

Military Board Office, 6th November, 1841.

To G. A. Bushby, Esq., *Secretary to Government, General Department.*

Sir,—Your letter dated the 1st ultimo, with its enclosures, was laid before the Meeting of the Asiatic Society held in this month, and the Meeting referred the subject to the Committee of Papers, in order that full consideration might be given to the important subject urged by the Honorable Court of Directors upon the attention of the Society, in connexion with the formation of a Museum of Economic Geology for India, and the collection and arrangement of specimens here, of which duplicates should be transmitted for preservation in appropriate Museums in England.

2.—The Governor of Bengal is aware, that a suitable room of our premises has been assigned for the specimens brought to India by Captain Tremenheere, and that the Society has a large assortment of Mineralogical and other specimens, collected from various parts of India, from which, with care in the arrangement, and particular attention to the localities from which the articles have been procured, a valuable Museum of the kind desired, might now be commenced upon, so as to form nucleus of an Œconomic institution, to which all public officers might refer for information, and into which all further objects of useful discovery might, as collected by the Officers of Government, be brought for safe deposit and investigation.

3.—But for the arrangement of the specimens we possess in the scientific order requisite, and for their discrimination and proper ascertainment, the entire services of a gentleman versed in somewhat more than the rudiments of sciences of Geology and Mineralogy, and a proficient in Chemistry, and the use of tests for purposes of analysis, will obviously be indispensible; and it would be a great advantage that this gentleman should also not be a stranger to the Geography and languages of the country, and that he should be known to, and in habits of correspondence with, persons engaged in similar pursuits in different parts of India.

4.—The Curator the Society has recently obtained from Europe, Mr. Blyth, is eminent in all departments of Zoology, and his indefatigable exertions in this line, have already increased largely the value of the Museum, as well by the addition of an infinity of new specimens excellently set up, as by the discovery amongst our neglected stores of objects valuable to science which had escaped the less accurate investigation of his predecessors in this line. But Mr. Blyth's whole time is occupied in this very extensive branch of the Museum, and he does not profess at present, to be sufficiently acquainted with Mineralogy and Geology, to be able to superintend the formation of the desired Œconomic Museum; besides that being new to the country, and unacquainted with its localities and languages, he would feel greatly at a loss in the attempt to arrange and investigate the affinities of soil, and other characteristic peculiarities of provinces and districts, which it should be the aim of an Œconomic Museum to display.

5.—The Society has been indebted to Mr. Piddington for all that has yet been done in this department; the qualifications of this gentleman as a chemist and man of general science, are well known to the Governor of Bengal, but his attainments in the branches of Geology and Mineralogy, and the attention he has given to these sciences in their special application to India, may not have been antecedently represented to his Lordship. He is regarded by the members of the Committee, and by the Society for which they are acting, as eminently qualified to undertake the particular duties and charge to which their attention has been thus directed.

6.—Circumstances at the present juncture enable this gentleman to give to the Society a large portion of his valuable time, but render it impossible, that they should be accepted without remuneration. On the part of the President and Committee of Papers of the Society therefore, I am directed to request you will submit to his Lordship, that if importance be attached to prosecuting researches in Œconomic Geology, and to the careful examination and arrangement of specimens and objects connected with this science, they see no means of satisfying the wishes of the Government and of the Court of Directors, except by securing the services of Mr. Piddington, on a separate salary equal to that now assigned to the Curator; viz. 250 Rupees per mensem. We cannot hope that Mr. Piddington will engage permanently, or for any given period on these terms, but we doubt not that his exertions for the time of his devoting himself to this branch of our Museum, will place the department on such a footing, as will much facilitate its being afterwards carried on by less competent persons; and in this manner, a basis will be laid for a Museum of infinite value to science and to the public service.

7.—Mr. Piddington's services, if engaged, will be of infinite use to the Society in other branches also, for he is versed in Numismatology, and proficient in all the knowledge required for the discrimination and arrangement of scientific objects. The Committee would propose for him the title, " Joint Curator," giving to his special charge, as well the Geological as any other parts of the Museum, that we might consider him specially qualified to arrange and report upon.

I have &c. for the Committee,
(Signed) H. Torrens,
Secretary to the Asiatic Society.

Asiatic Society's Rooms, Calcutta, the 27th Jan. 1842.

No. 265.

To H. TORRENS, ESQ. *Secretary to the Asiatic Society.*

General Dept.

SIR,—I am directed to acknowledge the receipt of your letter, dated the 27th ultimo, conveying the recommendation of the President and Committee of Papers of the Asiatic Society for the appointment of Mr. Piddington as Joint Curator to the Museum of Economic Geology, with reference to the orders for the formation of a Museum of Economic Geology for India.

2.—In reply I am desired to state, that the Right Honorable the Governor of Bengal, with the concurrence of the Government of India, has been pleased to sanction a payment from the Treasury of 250 Rupees a month for the remuneration of Mr. H. Piddington in the appointment of "Joint Curator" to the Museum of Economic Geology, which the President and Committee propose to confer on that gentleman. The accompanying Extract, Paragraph 5, from a letter dated the 23d June 1841, in the Revenue Department, from the Honorable the Court of Directors, will inform the Society as to the views of the Honorable the Court of Directors respecting the appointment which has been thus constituted, and the duties that he is expected to perform in connection with the Museum of Economic Geology.

3.—I am directed to take this opportunity of transmitting for the information of the Asiatic Society, a copy of a despatch from the Court of Directors, No. 14 of 1841, dated the 2d of November, and of the Letter and Memorandum from Mr. Delabeche therein mentioned.

I am, &c. &c.
G. A. BUSHBY,
Secretary to the Government of Bengal.

FORT WILLIAM, *the* 26*th February,* 1842.

Extract from letter, No. 10 *of* 1841, *from the Honorable the Court of Directors, in the Revenue Department, dated the* 23*d June.*

5.—We cannot doubt that much benefit may be derived from such an institution under proper superintendence. In order, however, to make it practically useful, we apprehend that it will be necessary to place it under the charge of an individual sufficiently versed in Chemistry to be competent to make the necessary analysis of ores, soils, &c. and to suggest the means of turning those analyses to account. To this individual might also be assigned the care of the Mineralogical records deposited in the Museum, which will probably in no long time become so voluminous as to be altogether useless, unless properly classified and arranged. In our despatch of the 27th May, (No. 5,) 1840, we anticipated the necessity of the appointment of such an officer, and we shall not object to your assigning a moderate salary to any individual who may be found competent for the discharge of the duties of such a situation.

No. 14 of 1841.

Our Governor of the Presidency of Fort William in Bengal.

In continuation of our dispatch in this Department, (Museum of Economic Geology,) dated the 8th September last, (No. 13,) we transmit for your information copy of a letter (dated 9th Sept. 1841,) which we have received from Mr. Delabeche, and of the Memorandum which accompanied it, on the subject of the establishment of a Museum of Economic Geology in India.

We are,
Your loving Friends,
(Signed) George Lyall,
„ J. L. Lushington,
„ H. Lindsay,
„ John Loch,
„ H. Shank,
„ J. Petty Muspratt,
„ C. Mills,
„ J. W. Hogg,
„ F. Warden,
„ John Cotton,
„ Archdeacon Robertson,
„ Henry Alexander,
„ Henry Willock.

London, the 2*d Nov.* 1841.

Ordnance Geological Survey, Haverfordwest,
South Wales, 9th Sept., 1841.
JAMES MELVILL, ESQ. &c. &c. &c.

SIR,—I have the honor to acknowledge the receipt of your communication of the 2d instant, accompanied by the report to which it refers of Mr. Piddington, on a collection of specimens taken to India by Captain Tremenheere, as a basis for a collection for a Museum of Economic Geology in India.

As the Court of Directors of the East India Company were pleased to say that they would be happy to receive any communication on the subject which I might make, I have ventured to send the accompanying memorandum, and have therein given a brief account of the Museum of Economic Geology, established under Her Majesty's Government, for the information of the Directors.

Permit me through you to return the Directors my sincere thanks for their kind offer of sending specimens from India to our Museum. Every thing which relates to the Metallurgical processes of India would be highly valuable: specimens of steel, such as is used for arms, would be particularly so. Ores of the useful metals, and any information relating to their mode of occurrence would be very acceptable. Models, or drawings from which models could be constructed, of any of the native mining machinery, methods of reducing the metals, or tools used in mining, would be valuable, however simple these contrivances may be.

Perhaps you will do me the favour to assure the Dirrectors, that if they may consider any service I can render in the formation of the proposed Museum at all desirable at any time, I shall esteem myself fortunate in being able to afford it.

(Signed) H. F. DELABECHE,
Director, Ordnance Geological Survey.

Memorandum respecting a Proposed Museum of Economic Geology in India.

Not being aware of how far the Directors of the East India Company may be desirous of forming in India a Museum of Economic Geology, similar to that established under Her Majesty's Government in this country, modifying it only to suit the difference of conditions existing in the respective countries, or may be informed of the exact character and design of the Museum of Economic Geology in London, perhaps it may be useful, and not altogether out of place, briefly to state the objects for which the latter were founded, and to shew the manner in which we endeavour to attain them, before I venture to offer any observations which Mr. Piddington's Report may have suggested on the proposed establishment in India.

The Museum of Economic Geology was founded, in order to obtain a more perfect and general knowledge of the mineral wealth of the United Kingdom and its colonies than now exists,* and to render the knowledge thus obtained readily available to the public, endeavouring to promote an increase in the advantages to be derived from our mineral wealth, by shewing where and in what manner mineral substances at present untouched in particular districts may be profitably worked; by pointing out that by adopting the mode of working elsewhere either in this or other countries, mineral substances may be more profitably raised than they now are in certain districts, and by preventing an useless expenditure of time and capital in researches which can only end in disappointment.

Another chief object is to shew the application of Geology to Agriculture, and to afford to the public the facility of obtaining correct analysis of soils at a rate so moderate, as to bring them within the means of the many, and thus, by obtaining a multitude of facts relating to soils, be enabled to arrive at conclusions which may be of very material benefit to the agriculture of the country, and which might not otherwise have been rendered so readily apparent.

In fact, the Museum may be considered, without further detail, as an establishment founded to shew and promote the application of Geology to the useful purposes of life in a variety of important ways, and thus aid in advancing the general welfare of the country.

Though the establishment is termed a Museum, from containing collections of mineral and metallurgical specimens, models, &c., these collections only constitute a part of the general whole, and are solely intended to render that whole effective. Under the same roof, there is a well appointed Laboratory, an office for the accumulation and preservation of the mining documents of the United Kingdom, and a work-shop for the construction of models from working drawings, both British and foreign. Mr. Richard Phillips, F. R. S., long distinguished as an analytical chemist of the first order, has charge of the Laboratory and of the mineral and metallurgical collections, and Mr. Jordan, a gentleman of considerable ability, and previously Secretary of the Polytechnic Society of Cornwall, superintends the Mining Record Office and the Model Department. Both gentlemen receive pupils under certain regulations, the former in analytical chemistry, metallurgy and mineralogy; the latter for mining, section and plan drawing, and mining machinery; it being considered a great object to teach as much as possible by aid of the establishment, its collections of mineral and metallurgical specimens, models, &c. being freely employed for the purpose, and not intended for mere shew, though eventually the public will be admitted to view them gratuitously in the same manner as the collections of the British Museum are exhibited.

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* Itself an object of great national importance, as even at present it is known that the annual value of the Coals (taken at the pit mouth, and of the metals, and of a few other mineral products) in their first merchantable conditions raised in the United Kingdom, exceeds £20,000,000.

The establishment may be considered as formed to a certain extent of distinct parts, though they are necessarily much blended with each other, and may be said to consist of the Mineral and Metallurgical Collection, the Laboratory, the Model Department, and the Mining Record Office.

The Mineral and Metallurgical Collections are divided into,

a.—The various ores of the useful metals at present raised in the United Kingdom and its Colonies.

b.—Specimens to illustrate the mode in which these ores occur, and the general conditions under which they are found.

c.—A metallurgical series, shewing the mode of reducing the ores to the metallic state, as practised in the United Kingdom or Colonies.

d.—The foreign ores of the useful metals, in order to accustom the eye of the British miner to all known appearances of the ores of the useful metals.

e.—Specimens illustrative of the mode of occurrence of these foreign ores, so that the British miner may see wherein this may differ from, or agree with, the manner in which ores are found in the United Kingdom.

f.—A series illustrating the manner in which the ores are reduced to the metallic state in foreign countries.*

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* The British specimens of ores and metallurgical processes are kept distinct from the foreign, to shew at one glance what is really known or done in the United Kingdom, and therefore what more or less is known, as relates to the same subjects in other countries.

g.—A series illustrating the manufacture of steel, brass, and other metallic compounds or alloys.

h.—An extensive series, illustrating the rocks which either have been or may be advantageously employed for Architectural or Engineering purposes.

i.—The various cements, bricks, tiles, or other artificial mineral compounds which may be, or have been, employed for the same purposes.

k.—A series of the substances used in the manufacture, and illustrating the manufacture itself of British porcelain, earthen-ware, and the coarser potteries.

l.—A series of soils, with their analysis attached, and a notice of such circumstances connected with the climate and the situation of the localities where they occur as can be obtained, accompanied by such specimens of the subsoils or rocks in which they rest as can be procured.

In the *Laboratory*, analyses of mineral substances, such as ores, rocks, soils, &c. are made at a regulated price for the public, who not only thus obtain correct information without fear of fraud from interested motives, but also do so at moderate cost. Analyses are also executed for such Government Departments as may desire them; and pupils, as above mentioned, are received.

The *Model Department* will consist (and numerous important models are already in the collection) of models to illustrate mining operations, from the most simple conditions up to the most complicated of mining machinery, and of such operations connected with mines as can be well shewn by models, not only British but foreign, and of furnaces and other works for the reduction of the metals. The tools and instruments used in mining in different countries, with specimens of the ropes, chains, &c. employed, form also part of this collection.

In the Mining Record Office, not only will the plans and sections which relate to British mining be accumulated, but all documents relating to foreign mines which can be obtained, will be added to the collection, and it is expected, from the arrangements which have been made, that much important information will thus be brought together. Geological maps and sections of various countries will be here assembled, and it is intended eventually to form a *Library*, containing works in various languages, which may relate to the application of Geology to the useful purposes of life.

It might, at first sight be supposed, however desirable such an establishment as this, which has been thus briefly noticed, may be in India or elsewhere, that it would require considerable expenditure and much trouble to form. From experience I can say, that I believe the contrary would be the case, provided it were placed directly under a Government, which necessarily in almost all countries, possesses the means of carrying out the objects of an institution of this kind in a manner which cannot be within the reach of any body of men formed into a society, however active the members of that body may be.

The collections in the Museum of Economic Geology though no doubt valuable, have cost the country a mere trifle, having been chiefly presented by persons anxious to promote the success of the institution, because it was national, and belonged to the public, under the controul and care of Government. At the same time it must be admitted, that a large portion of the collections have been formed through the exertions of the Ordnance Geological Survey, during its progress through the country, causing the Museum to be more known and appreciated than it might otherwise so soon have been, and thus inducing many influential persons to make extensive presents to it.

It would appear from experience, that in such establishments outlays of money are at first less requisite than arrangements by which the various means of information at the disposal of a Government can be rendered available, and at a suitable place set apart for the reception of the different specimens, models, and other objects of interest that can be collected, waiting, as was done at the Museum of Economic Geology in London, until the accumulation of information and of specimens, models, or other objects of interest should be sufficiently great to carry out the design of the establishment on a more extended scale; it being at the same time observed, that a laboratory and a good analytic chemist appointed to it, may be considered as among the earliest requisites.

The collections taken out to India by Captain Tremenheere, were necessarily incomplete, and were merely intended as a foundation for a more extended series of specimens, illustrative of the applications of Geology to the useful purposes of life; but like all such first collections, they are most valuable as constituting such a foundation, and in this instance, they have been the means of calling forth a very able report from Mr. Piddington, as to his views respecting the requisites for collections of this kind in India. Though Mr. Piddington's catalogue of *desiderata* may appear large, and refer perhaps, more to a complete series of collections, than to what may be sufficient and essentially required for the well-working of a Museum of Economic Geology in India, yet a large part of them could be supplied at a very moderate cost. Time and opportunity will be required far more than money for a very large part of the desired collections, though no doubt, some small outlays may from time to time be necessary. It would be our earnest desire, as well as our duty, at the Museum of Economic Geology, to aid an institution of the like kind established under the East India Company in India, and it would be very easy to endeavour, as much as possible, to obtain duplicates of Foreign as well as British specimens, likely to be useful in India, when we collect them for ourselves. Copies of the plans and sections of the Metalliferous and Coal mines in our Mining Record Office could readily be furnished at the expense of the copying, and care could be taken to select only such as would be likely to be useful in India. Arrangements might be made to find competent persons to construct copies of such of our models as might be thought valuable, particularly those required in the earliest conditions of a mine. In fact, much could be accomplished, at once and readily, in this manner, should it meet the approbation of the Directors of the East India Company; and as regards the applications of Geology under consideration, we might be rendered available for what is done in the United Kingdom and in many parts of Europe; at the same time it would be desirable that applications to the friends of India, resident in this part of the world, should not be neglected.

The most important part of the collections must necessarily be made in India, and can probably be best accomplished in the manner pointed out by Capt. Tremenheere and Mr. Piddington.

I would venture to suggest, that it would be very desirable by any methods that may be deemed most expedient, as early as possible to procure an estimate, however rough it may be, of the mineral resources of India, *i. e.* that those points which may appear the most promising, may receive the required attention, and the real state of knowledge on this subject be shewn by something like effective and trust-worthy documents. By the same means, the collections might gradually become considerable, comparisons be instituted where comparisons were likely to be useful, both as regards the parts of India with each other, and with foreign countries. Analysis of soils, which should be made as well with regard to their physical as chemical conditions, due attention being paid to climate, would accumulate, and eventually a mass of information would be collected, which could not fail very materially to assist in improving the agriculture, and developing the mineral wealth of the vast territory under the Government of the East India Company.

(Signed) H. F. Delabeche,
Director of the Museum of Economic Geology.

9th September, 1841.

To H. Torrens, Esq., *Secretary Asiatic Society.*

Sir,—With reference to our conversation on the subject of a Laboratory for the Museum of Economic Geology, I set down here as requested, such Memoranda as occur to me for the information of the Committee of Papers and the Society.

1.—" A laboratory and a good analytical chemist appointed to it may be considered as amongst the earliest requisites for a Museum of Economic Geology," says Mr. Delabeche, in replying to the Court of Directors on their referring to him my report of February 1841, and he is writing in England. We may add here, I think, " in India far more than in England ?"

2.—The arrangements for a laboratory require a room, and I cannot see how to obtain one of improper size, without adding to our present accommodation.

3.—The arrangement proposed by you, would give us additional room for many things which now become much crowded: and for models, records, &c. which will gradually accumulate in the Museum of Economic Geology, in which, be it remembered, we have to collect *both* Indian and European knowledge and specimens.

4.—We require room for coarse furnace work, and for our more delicate analytical operations, which cannot (be it remembered) be carried on in open rooms, or left to chance-meddling, or exposed to theft if of value. Room for the Superintendent, where he can work undisturbed by visitors, is also highly desirable under existing arrangements, and at the very best time for work, a morning is often lost by the indispensable civilities to chance visitors. Where laboratory work is going on, this is out of the question.

5.—It may appear, that I am asking for means and appliances more extensive than our present Museum of Economic Geology requires; but to this it may be replied, that there is no lack of laboratory work even now, and when we make known our views and desires, there will be plenty more: add to which, that the first reference to us from Government *may* be our requiring all the resources of a good laboratory to reply to it creditably. I may be excused, if I remark in conclusion, that it belongs to the Society, with such an opening as is now afforded to it, to shew its readiness to do honour to the patronage it meets here and at home.

H. Piddington.

16*th March,* 1842.

Note.—The means and appliances to which Mr. Piddington alludes, as necessary for the efficient establishment of the Museum, have been afforded by the Society in the same spirit of liberality and zeal for the cause of science, which actuated the Honorable the Court of Directors and the Government of India, in contributing so eminently to the formation of the institution. The Honorable the President of the Asiatic Society, (H. T. Prinsep, Esq.) at once proposed to make such additions to the spacious building which contains our Library and Museum, as might not only supply a proper Laboratory, but also give additional room for the Geological and Mineralogical department, as well as allow of the appropriation of a new and handsome apartment to be added to the upper story of the house to a better disposition of our Books, or to our Ornithological Collection, which daily undergoes augmentation. These works are in a forward state, the President's proposition having been warmly adopted.

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DRAWN UP BY H. PIDDINGTON, CURATOR MUSEUM ECONOMIC GEOLOGY, ASIATIC SOCIETY'S MUSEUM.

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Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—January. 1841.

Day.	Morning Tide A. M.					Wind.	Evening Tide, P. M.					Wind.	Weather, &c.
	Low Water.		High Water.		Range of Tide.		Low Water.		High Water.		Range of Tide.		
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
1 Friday,	9 16	5 6	3 18	9 4	3 10	N.	9 47	5 3	3 39	10 3	5 0	N.	7 15 A. M. light rain, noon overcast, 4. 35, P. M. a light shower.
2 „	9 58	5 9	3 56	9 1	3 4	N.	10 47	6 1	4 6	9 2	3 1	N.	——— day alternately clear and cloudy.
3 Sunday,	11 19	4 11	5 18	8 9	3 10	N.	11 53	5 10	5 28	8 6	2 8	E.	——— clear all day.
4 „	0 0	0 0	6 17	9 4	0 0	N.	0 54	4 8	7 26	9 11	5 3	N. E. ..	——— ditto ditto.
5 „	1 22	5 7	7 38	10 7	5 0	N.	1 43	3 9	8 19	10 1	6 4	N. E. ..	——— ditto ditto.
6 „	1 57	4 9	8 37	11 2	6 5	N. W.	2 27	2 9	8 54	10 6	7 9	N.	6 7 A. M. squall from N. W. with rain, noon cloudy, 5 50 P. M. rain.
7 ○	2 58	4 7	9 4	11 6	6 11	N. W.	3 15	2 7	9 50	11 4	8 9	N.	Clear all day.
8 „	3 52	4 5	10 18	12 1	7 8	N.	4 17	2 1	10 58	11 3	9 2	N.	6 A. M. clear, 11 45 A. M. cloudy with light showers occasionaly, 11 15 P. M. rain.
9 „	4 7	3 9	11 15	12 8	8 11	N. W.	5 12	2 3	11 27	11 5	9 2	N.	4 50 A. M. rain, noon cloudy, 5 18 P. M. rain
10 Sunday,	6 2	3 9	0 0	0 0	0 0	N.	6 27	3 7	0 17	12 11	9 4	N.	——— day cloudy, 4 25 P. M. light rain.
11 „	6 43	4 5	12 43	11 7	7 2	N. E. ..	7 12	4 7	12 52	12 3	7 8	S. E ..	——— day alternately clear and cloudy, 3 43 P. M. showers.
12 „	7 13	4 9	1 19	11 3	6 6	N.	7 48	4 9	1 7	11 8	6 11	W.	——— day cloudy, 11 47 A. M. rain, 52 P. M. squall from westward with heavy showers.
13 „	8 6	5 3	2 9	10 11	5 8	N.	8 12	4 10	2 13	10 11	6 1	N. W.	——— ditto ditto.
14 („	8 18	5 7	2 19	10 4	4 9	N.	8 53	5 6	2 27	8 6	3 0	S. E. ..	——— day alternately clear and cloudy, 5 4 P. M. very light drizzling rain.
15 „	9 3	6 1	3 9	8 7	2 6	N.	9 29	5 7	3 12	8 9	3 2	Westy,	Forenoon clear, 1 15 P. M. showers 1 37 thunder.
16 „	9 47	6 3	3 42	8 10	2 7	N.	10 49	5 7	4 11	8 7	3 0	N. E. ..	——— day alternately clear and cloudy

Register of the Rise and Fall of the Tide at Prince of Wales Island and Singapore, furnished to the Editor by order of the Government of India,—January 1841.—*(Continued.)*

Day.	Morning Tide A. M.						Evening Tide P. M.						Weather, &c.
	Low Water.		High Water.		Range of Tide.	Wind.	Low Water.		High Water.		Range of Tide.	Wind.	
	Time.	Height.	Time.	Height.			Time.	Height.	Time.	Height.			
17 Sunday,	10 57	5 2	5 28	9 3	4 1	N.	11 49	5 4	5 38	9 1	3 9	N. E. ..	Clear all day.
18 ,,	0 0	0 0	6 25	9 4	0 0	N. E. ..	0 57	3 9	7 42	9 3	5 6	N. E. ..	Forenoon rather cloudy, 11 30 A. M. rain in large drops, afternoon clear.
19 ,,	1 18	5 1	7 32	9 5	4 4	N.	1 49	3 8	8 13	9 4	5 8	N. E. ..	—— ditto ditto 10 55 A. M. light rain, 1 P. M. thunder, ditto ditto.
20 ,,	2 12	5 3	8 27	9 7	4 4	N.	2 47	3 7	9 15	9 6	5 9	E, ...	—— day alternately clear and cloudy.
21 ,,	3 16	5 2	9 23	10 6	5 4	N. E. ..	3 43	3 1	9 52	10 3	7 2	N.	—— ditto ditto, 2 47 P. M. drizzling rain.
22 ●	4 2	4 11	10 5	11 3	6 4	N. E. ..	4 54	2 11	11 7	10 7	7 8	N.	—— ditto ditto, 11 20 A. M. heavy showers with thunder.
23 ,,	5 14	4 9	11 9	11 6	6 9	Easterly.	5 49	2 8	11 56	10 9	8 1	N.	—— ditto ditto.
24 Sunday,	6 4	5 7	0 0	0 0	0 0	N. E. ..	6 15	2 3	0 8	11 9	9 6	N. E. ..	—— ditto ditto.
25 ,,	6 42	5 10	0 32	10 11	5 1	N.	6 53	2 1	0 57	11 6	9 5	N.	—— ditto ditto, 48′ P. M. passing showers, 1 20 P. M. squall with rain.
26 ,,	7 9	6 2	1 4	10 10	4 8	N.	7 12	2 4	1 9	11 8	9 4	Sty. Ny.	6 55 A. M. drizzling rain. Day overcast.
27 ,,	7 17	6 4	1 17	10 11	4 7	N.	7 42	2 9	1 20	11 9	9 0	Sty. Ny.	—— day alternately clear and cloudy.
28 ,,	7 54	6 3	1 56	10 9	4 6	N. W...	8 4	3 2	2 0	11 2	8 0	N. W..	5 32 A. M. drizzling rain. Day alternately clear and cloudy, 2. 58 P. M. rain.
29 ,,	8 9	5 8	2 12	10 3	4 7	N.	8 11	3 8	2 18	10 6	6 10	N. E. ..	7 57 A. M. drizzling rain. Day alternately clear and cloudy.
30 ☽	8 2	5 5	2 29	9 10	4 5	N.	8 45	5 7	2 5	9 11	4 4	N.	—— day alternately clear and cloudy, 1 58 P. M. squall with rain.
31 Sunday,	8 56	5 3	3 2	9 8	4 5	N.	0 0	0 0	3 13	9 6	0 0	N.	—— day alternately clear and cloudy.

[Signed,] WM. SCOTT,
Assist. Master Attendant.

Prince of Wales' Island and Singapore, furnished to the Editor by order of the Government of India.—March 1841.

Evening Tide, P. M.					Wind.	Rain in Inches.	Weather.			
Low Water.		High Water.		Range of Tide.			Morning A. M.		Evening P. M.	
Time.	Height.	Time.	Height.				2 16	8 16	2 16	8 16
9 06	5 02	4 29·5	6 09·4	1 07·4	North, ...	..	Serene, ...	\ Harison,	∩Z & #	\
10 41	5 10·7	6 48	6 07·6	00 08·9	N. & N. N. E.....	..	Serene, ...	\	∩E. & W.	\
00 34·5	2 00·1	8 44	7 02·5	5 02·4	V. & N. E. by N.	..	Z Clear, ...	\#Zclear	∩#	\—#\Z
1 56	1 09·4	9 36·5	8 00	6 02·6	V. & N. by E.	..	Serene, ...	\—	∩#	Serene,
3 00	1 02·6	10 03	8 04·8	7 02·2	V. & N. E. by N.	..	..	\#Zclear	\Z & S. #	—#
3 51	1 02·7	10 40	8 11·5	7 08·8	V. & N. W. by W.	..	Serene, ...	∩—#\Z	∩#Z clear,	\—#\∩Z
4 28	1 01·2	11 08·5	9 00·1	7 10·9	W. & N. N. E.	● 0 31	..	..	..	..
5 16	1 06	11 26	9 03·3	7 09·3	V. & N. E. by N.	..	\	\Z & #—	\—#\∩Z	Serene,
5 36	1 10	11 37·5	9 04·6	7 06·6	E. N. E. & N. E.	..	Serene, ...	\Z & #—	∩—#\—Z	∩\—
6 13	2 02·5	..	..	..	E. by N.	0 25	\	\Z\∩#	Nimbus,	Overcast, ..
	No obser-vation.			..	....	0 26	∩	∩&\--#Z clear	Nimbus,	Overcast, ..

Remarks.

The direction of the wind is taken at each of the Tides, and is put down in the same order as the Registry of the Tides in the weather column.

Z Stands for Zenith.

Ditto ditto Horizon.

\ Civus, — Stratus.

∩ Cumulus — all the other marks are combinations of these.

● New Moon.

☽ First Quarter.

○ Full Moon.

☾ Last Quarter

The time is mean time to the nearest

[illegible]	3 07·5	1 38	8 09·7	5 02·2	N. by W. & V.	..	—#\Z	\Z\—#	∩&∩--#\Z	Overcast, ..
7 30	4 00	2 08	7 11·5	3 11·5	N. N. W. & V.	0 15	Serene, ...	∩—#∩Z	Overcast, ..	Serene, ...
8 16	4 10	3 03	7 02·5	2 04·5	N.N E. & N. W. by N.	0 91	Serene, ...	..	..	..
8 35	5 05	4 00	6 02·4	00 09·4	N. N.E. &N.N.W.	0 18	Serene, ...	∩#	Overcast, ..	Z clear #—
9 46	6 00	8 14	6 00·5	00 00·5	North, ...	1 11	Serene, ...	\∩#	Overcast, ..	Z clear,
57 A.M. .o 1 09	3 04·5	9 00·5	6 08·2	3 03·7	V. &. W. by S.	0 04	..	—#\∩Z	∩	..
1 57	2 08·7	9 24	7 00	4 03·3	V. & N. W. by W.	0 01	..	—#	Overcast, ..	Overcast, ..
2 39.5	2 05·8	9 42	7 07·8	5 02	V. & N.	0 08	..	\∩Z	Overcast, ..	Serene, ...
3 20	2 00·6	10 02	8 00·7	6 00·1	V. & S. S. E.	0 06	..	\—#	∩\—	Overcast, ..
3 47	2 01	10 10·5	8 04	6 03	V. & N. by W.	..	..	..	..	..
4 08	1 10·8	10 26	8 08·1	6 09·3	V. & N. E. by N.	0 025	..	—#\Z	\Z	Serene, ...
4 57	1 11·5	10 55·5	8 11·2	6 11·7	N. E. by N. & N.	0 425	Serene, ...	—#\Z	Nimbus,	..
5 16	20 15	11 13	9 03	7 01·5	S. & N. N. W.....	0 225	..	∩#	∩#	—# Z clear,
5 50	2 07·4	11 37	9 06·5	6 11·1	S.E.byE. &N.E.N.	..	Z Clear,....	Overcast,	∩#\∩Z	..
6 10	3 01·5	11 55.5 00 25.5	9 07.2 9 06.8	6 05.7 6 05.3	N. W.	..	Z Clear,....	∩—#	∩#	∩#\Z
6 33	3 08·6	1 18	9 00	5 03·4	W. N. W. & V.	0 24	Serene, ...	— & ∩#	Zenith clear,	\ & \—
7 09	4 07·8	2 10·5	8 09·5	4 01·7	N. by E. & V.....	..	..	..	..	..
8 11	5 02·5	3 21·5	7 11	2 08·5	N. E. & E. by S.	..	Overcast,	∩	∩#\∩Z	Serene, ...
9 24	5 09·5	4 40	7 03·2	1 05·7	N. by W. &N.by W.	..	Serene,	∩#\Z	— & ∩#	Serene, ...
11 21	5 10	6 51·	7 01	1 03	S. by W. and S.	..	\ and \..	\∩	∩	∩# Z clear,
					Total, ...	4,275	Inches,			

minute.

(Sd.) E. M. ELLIOT, 2*d B. Engrs.*
Supt. Magt. Singapore.

ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensgmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the remarkable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to the number at present only, we are able to estimate the riches of the whole creation, and to explain the alternations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°. with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

HERMAN VON MEYER.

JOURNAL

OF THE

ASIATIC SOCIETY.

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Narrative of a Journey from Soobathoo to Shipke, in Chinese Tartary. By Lieut. A. Gerard, *Bengal Native Infantry, in* 1818.

From Soobathoo, in latitude 30° 58′ and longitude 77° 2′, situate about twenty miles from the plains, and 4,260 feet above the level of the sea, I marched to Mumleeg nine miles, three and a half miles from Soobathoo, crossed the Gumbur, an inconsiderable stream, but it had swollen so much from late rain, that its passage was effected with great difficulty. The road was a descent to the Gumbur, from which it slightly ascended.

22*d September.*—Marched to Simla thirteen and half miles. The road for the first eight and half miles was almost plain, then there was a steep ascent of one and half mile, and the last three were excellent, winding near the top of a range 7,000 feet high, and lying through a noble wood of many varieties of oak and pine.

23*d September.*—Marched to Bunee eleven miles. The road was level, leading amongst deep forests of pine, at the height of 8,000 and 9,000 feet above the sea. Thus far the path, which is practicable upon horseback, has been made by a company of Pioneers, for the facility of communication with the cantonment of Kotgoor, thirty-four miles further to the north-east.

24*th September.*—Marched to Pulana ten miles. Left the made-road six miles from last camp, and descended by an indifferent and slippery footpath to the village, which belongs to the Rana of Theog.

25th September.—Marched to the Kotkhaee eleven miles. The road lay along the bank of the Giree, one of the branches of the Jumna, and was often rocky and dangerous, the footpath being frequently overgrown with grass, and seldom half a foot in breadth.

Kotkhaee is the residence of the Kotgoor Rana, a hill chief under the protection of the British Government. It is situate on a most romantic spot, upon the point below which, two streams unite to form the Giree; on one side the rock is 182 feet perpendicular, and on the other there is a long flight of stone steps; neither of the streams, which are only twenty feet broad, are fordable, so by destroying the bridges, the place might be well defended against musketry. The Rana's residence is three stories high, and has a most imposing appearance; each story projects beyond the one beneath, and the top is crowned by a couple of handsome Chinese turrets, beautifully adorned with finely carved wooden work.

26th September.—Marched to Gujyndee eight miles. The road at first lay up the bed of one of the branches of the Giree, and there was a very steep and tiresome ascent of 2,400 feet to Deouree Pass, 8,885 feet high, from whence there was a descent to camp.

Gujyndee is in Nawur, a small district of Busahir, famed for its numerous iron mines; there are few spots here fit for cultivation, and the inhabitants, who are miners, live chiefly by their trade in iron. They work the mines only about three months in the year, and commence digging them in March, after the snow has sufficiently melted; at other times, they say, the earth falls in, and it is unsafe to work.

27th September.—Proceeded to Rooroo, a fatiguing march of thirteen miles, crossing a high range of mountains. Here we first came upon the Pabur, one of the feeders of the Tonse, which falls into the Jumna, and is a stream of considerable size. Barometrical observations give the extreme height of its bed 5,100 feet.

Rooroo is situate in Choara, one of the large divisions of Busahir, and the most populous and best cultivated spot I have seen in the hills; the dell is broad, and the ground is well adapted for rice fields, being watered by many canals cut from the river which winds through it.

Three marches more, or twenty-six miles, brought me to Jangleeg, the last and highest village in the valley of the Pabur, elevated 9,200 feet above the sea. The road latterly was extremely rugged and dangerous, at one time many hundred feet above the river, with a horrid precipice on the right, at another dipping down to the stream which rushes with violence over the rocks interspersed in its channel; as you advance, the dell in which the Pabur flows becomes gradually more contracted, the mountains assume a more naked and abrupt appearance, and the rapidity and turbulence of the river increases. From Jangleeg proceeded ten miles to a halting place called Moondoor, within two miles of the Brooang Pass over the great snowy range. The road was good, and lay in a broad grassy glen, between two spurs of the Himalayas, with the Pabur running through it. The soil of this valley is composed of black vegetable mould, which produces endless varieties of Alpine plants to the height of 13,000 feet. Belts of birch and pine reach nearly the same elevation, beyond which, scarcely any thing is seen but patches of brown grass.

The height of my camp, which was pitched beneath an immense projecting granitic rock, was 12,807 feet. We left the last cluster of birch trees 3 miles behind us, so had to send back that distance for firewood. The thermometer was 38° at night, and water froze hard.

Next day, 2*d October*, we pitched our tent on the crest of the pass, 15,095 feet above the level of the sea; the road was of the worst description, crossing the Pabur, which has its source near this, by an arch of snow of some extent, and then leading over huge detached masses of granite, hurled from the peaks above, and piled upon one another in the utmost disorder, with here and there some snow. The ascent was steep the whole way, and almost the only vegetation we noticed was grass in small tufts, which grew more scanty as we advanced to the pass, where it almost disappeared; above it was still seen thinly scattered, and interspersed with a few mosses.

Here I met my brother, who had left Soobathoo some time before me and travelled by a much more circuitous route.

We sent most of our servants down about five miles to a more genial climate, where wood was procurable, and remained ourselves at the top. The peaks immediately on either side of us were not more than 1,000 feet above us, but there were several not very far distant, which we could not then see, 18,000 feet high. We were lucky in getting the altitudes and bearings of the principal mountains across the Sutlej, which rear their white heads to the height of 20,000 feet and upwards.

The thermometer in a tent got up so high as 50° during the day, but at 4 P. M. it fell to the freezing point, and at 7 P. M. was 8° below it. We sat up till past 10 for the purpose of making astronomical observations, which in such a temperature was rather an uncomfortable occupation; our situation indeed in other respects was none of the most agreeable, we had but a scanty supply of firewood, which when kindled in the middle of the tent involved us in smoke, and we were somewhat incommoded by having to share our accommodation, such as it was, with our servants, whilst every now and then we were alarmed by the crash of rocks split asunder by the frost.

We had all severe headaches during the night, owing probably to the rarefaction of the air, but attributed by the natives to a poisonous plant said to grow most abundantly at the greatest elevations.

This pass is situate in latitude 31° 23′ and longitude 78° 12′, it separates Choara from Koonawur, another of the grand divisions of Busahir, which lies on both banks of the Sutlej, extending from latitude 31° 30′ to 32°, and from longitude 77° 53′ to 78° 46′. It is a secluded, rugged and barren country, seldom exceeding eight miles in breadth. It is terminated on the north and N. W. by a lofty chain of mountains covered with perpetual snow, upwards of 20,000 feet high, which separates it from Ludak; a similar range of the Himalayas bound it to the southward; on the east a pass almost 14,000 feet high divides it from Chinese Tartary; and on the west lies another of the principal divisions of Busahir.

The villages, which are elevated from 8,000 to 12,000 feet above the sea, are very thinly scattered, not more than two or three occur in a stage, and sometimes none at all for several days. In the summer season, from the reverberation of the solar rays, the heat in the bed of the Sutlej, and other large streams is oppressive, and quite sufficient to bring to maturity grapes of a delicious flavour, of which raisins and a spiritous liquor called *Rakh* are made. The inhabitants wear a frock of white blanket, often two-fold, reaching down to the knees, and having sleeves, a pair of trowsers and girdle of the same, a cap of black blanket like a bonnet, and shoes of which the upper part is woollen, and the sole alone leather. The people are very dark and extremely dirty, but they seem to enjoy a much greater degree of comfort in their habitations than any of the other mountaineers we have seen. The villages are generally large, and the houses spacious and even elegant; they are built of stone and wood, and either slated or flat roofed, the last is most common. The temples of the *Deotas* (deities) are magnificent, and adorned with a profusion of ornaments. There are two or three in almost every village, and sundry miraculous feats are ascribed to the gods to whom they are dedicated, scarcely one of whom but has the credit of having removed some mountain or vast rock for the purpose of rendering the roads passable, or of some other like achievement.

The level spaces of land in Koonawur are few, the crops are extremely poor, and a want of grain pervades the whole country. In time of scarcity, small pears and horse chesnuts, after being steeped in water to take away their bitterness, are dried and ground into flour. There are, however, no marks of poverty, and the natives subsist by exchanging raisins and wool for grain; they have little else to do but look after their vineyards, and attend to their flocks, which in summer are sent to pasturage at some distance from the villages. Bears are very numerous, and commit great ravages; in the grape season, during the whole night, several people from each village together with their dogs, are employed in driving them off.

The dogs are of a large ferocious breed, covered with wool and extremely adverse to strangers, whom they often bite and tear in a most shocking manner; they are commonly chained during the day, otherwise it would be dangerous to approach a village. The winter is rigorous, and for three months there is no moving out of the villages owing to the quantity of snow; during this season the inhabitants employ themselves in weaving blankets. They early begin to collect their winter stock of fuel and food for their cattle, which latter consists chiefly of the leaves of trees, and they pile it upon the tops of their houses.

The Koonawur language, of which we made a collection of nearly 1,000 words, differs much from the Hindee, most of the substantives ending in — *ing* and *ung*, and the verbs in — *mig* and *nig*.*

3rd October.—The thermometer was fifteen degrees below the freezing point and the cold intolerable, we therefore waited till two hours after sunrise, and then proceeded to the village of Brooang, distant eight and a half miles; the road lay over a thick snow bed for the first mile, and then led through extensive woods of various sorts of trees, amongst which we recognised the hazel, plane, horse chesnut, and many other European plants. The way was often rugged, and a steep descent of 7,600 feet perpendicular height. On the road we found black currants and raspberries in the greatest perfection, of which we preserved a large quantity, and on our arrival at camp we feasted on grapes. Brooang is a small village in Tookpa, one of the subdivisions of Koonawur, under the Wuzeer Teekumdas. It is situate near the Buspa river, and about two miles from the left bank of the Sutlej.

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* This vocabulary has fortunately been preserved, and will shortly appear.—Ed.

4th October.—Marched to Pooaree, a distance of twelve and a half miles. The road was extremely bad, lying often upon the face of a naked stone inclined to the horizon at a considerable angle, with a precipice of many hundred feet on the outer side; it was no great ascent or descent, but so much caution was necessary to prevent the traveller from slipping off the rocks into the river Sutlej, which lay close upon our left, that the journey took us up twelve hours. To-day we crossed the Buspa, a large stream forty two feet broad, whose source is amongst snow, five or six marches S. E. of Brooang.

5th October.—Proceeded to Rispè, a march of thirteen and half miles, likewise occupying us the whole day. The road which lay through thin forests of pine was not so dangerous as yesterday's, but consisted of several steep ascents and descents upon rocks of crumbling granite of 2,000 feet each. We had a grand view of the Kylas or Ruldung mountains from the large town of Reedung or Ribe, three and half miles before we reached camp; some idea of it may be formed by imagining an assemblage of pointed peaks presenting a vast surface of snow, viewed under an angle of twenty-seven degrees, and at a distance of not more than five miles in a direct line. The height of our station was 8,000 feet, and the Kylas peaks were 12,000 higher.

At Rispè we first saw Lamas, and near this place we passed several tumuli from ten to forty feet in length, two broad, and about four high, they are constructed of loose stones without cement, and upon their tops are numerous pieces of slate of all shapes and sizes carved with strange characters, they are called manè, like the *manes αἱ ψυχαὶ τῶν νεκρῶν,* or souls of the defunct, see verq. 3. Æ. n. v. 303. and are erected over the graves of the Lamas. There are invariably roads on each side of them, and the natives, from some superstitious custom, always leave them on the right hand, and will rather make a circuit of half a mile than pass them on the wrong side.

6th October.—Marched to Murung five miles. The road was pretty good along the left bank of the Sutluj, crossing a river named Teedoong, whose source is in the Chinese dominions four day's journey to the eastward.

Murung is a Lama town of considerable size, consisting of seven or eight distinct divisions, and beautifully situated chiefly upon a southern exposure, in a glen which forms the greater part of an ellipse, through it runs a transparent stream, upon the banks of which are extensive vineyards and orchards, abundantly supplied with water by numerous rills. The dell is encircled by lofty mountains at an angle of twenty-five degrees on every side, except on the westward, where it is open towards the Sutlej, on the bank of which there is a small fort. The situation is extremely fine, and the approach to it highly picturesque, leading along the bank of a canal, and through an avenue of apricot trees. Near this place there are a great many piles of stones with inscriptions, and afterwards we met with them almost at every village, until we reached Pangee, on our return where they end. We also saw a number of temples called Chosten, which are likewise to be found in the vicinity of every Lama habitation; they consist of an enclosure formed of three walls with a roof and open in front, in the inside of them are one or more small white-washed buildings shaped like urns.

It was our intention to have proceeded further, but the people told us the next village was at such a distance, and the ascent so fatiguing, with no water on the way, that we could not possibly reach it that night.

7th October.—Marched to Nisung eight miles. The road commenced with a very tiresome ascent of 5,300 feet perpendicular height; here we were delighted to find numerous beds of juniper and some gooseberries, which were the first we had seen for a long period of years; we were in great hopes we should have met with heath, but saw none. At the top of Toongrung Pass, 13,739 feet high, it began to snow, and the thermometer was below the freezing point, so we were glad to make the best of our way down; the foot-path was good, but a steep descent through juniper and thyme of many kinds to Nisung, a small Lama village situate near the Taglak'har, a large stream which rises in Chinese Tartary three or four marches to the eastward. The extreme height of this village by corresponding barometrical observations is 10,165 feet, and grapes do not ripen here. There are many gardens of fine large turnips belonging to the village, fenced around with hedges of gooseberries; the latter are of the red sort, small and extremely acid, but make a capital tart.

8th October.—We were delayed till 2 P. M., in order to get grain ground for the consumption of our people, there being no village at the next stage. We marched only one and three-quarter mile, and the road at first was a descent to the Taglak'har, and then a steep ascent of 2,000 feet, most part of the way up a slope of forty degrees, and over rugged rocks. We were obliged to halt here, there being no water for many miles in advance.

9th October.—Marched ten miles to the bed of a mountain torrent, and did not arrive till an hour after dark. This day's journey was one of the most tiresome we had experienced, crossing two mountains of 12,000 and 13,000 feet, the ascents and descents, one of which was full 4,000 feet in perpendicular height, were steeper for a longer continuance than any we had yet seen, and the path was strewed with broken slate, which gave way under the feet. Neither tent nor baggage arrived, and we had nothing to eat but cakes of very coarse meal, which hunger however made palatable; upon this kind of food, together with a few partridges which our people occasionally shot, and without either plates and knives or forks, we lived for five days. We should have afforded an amusing spectacle, seated upon blankets near a fire in the open air, surrounded by our servants, dissecting the partridges with the *kookree*, or short sword worn by the Goorkhalees, and smoking plain tobacco out of a pipe little better than what is used by the lowest classes. Novelty however has its charms, and our being in a country hitherto untrodden by an European, gave us a delight amidst our most toilsome marches, scarcely to be imagined by a person who has never been in the same situation.

10th October.—Marched to Dabling six and three-quarter miles. The road was pretty good, lying near the river. We went a mile out of the direct way, to visit the Namptoo Sango, a wooden bridge across the Sutlej. The river was here 106 feet broad, with large rocks in its bed, and the bridge seventy-eight feet above the stream, which rushes with rapid violence between blocks of granite. We in vain tried to measure its depth, and although we had a heaving lead for the purpose, of no less than ten pounds weight, we could not effect it, for the force of the current was so great as to sweep it down long ere it reached the bottom. We found the bed of the river 8,200 feet above the sea.

11*th October.*—Marched to Numgeea nine miles. The footpath was good and even, lying upon the left bank of the Sutlej. To-day we made a circuit to look at the conflux of the Lee with the Sutlej. The Lee is a river of considerable breadth, coming from Ludak on the northward, but it is not very deep, and flows in a clear stream with a moderate current, whilst the Sutlej is muddy, and rushes with great velocity and a stunning noise.

Since leaving Pooaree, the trees had gradually become more scanty; in the vicinity of Numgeea there is little vegetation, grass and thyme are but thinly scattered in small tufts, and a solitary dwarf pine appears here and there.

12*th October.*—Marched to Shipkè nine miles. The road ascended a little, and then there was a steep descent into the bed of the Oopsung. Here the rocks are more rugged than any we had yet seen, they are rent in every direction, piled upon one another in wild disorder, in a most extraordinary manner not to be described, overhanging the path, and threatening destruction to the traveller. From the Oopsung, the road was a tiresome and rocky ascent to the pass which separates Koonawur from the Chinese dominions, 13,518 feet above the level of the sea; here the scene was entirely changed, a more marked difference can scarcely exist. The mountains to the eastward were quite of another nature from those we before met with, they are of granite broken into gravel, forming regular slopes, and neither abrupt nor rocky. The country in that direction has a most desolate and dreary aspect, not a single tree or blade of green grass was distinguishable for near 30 miles, the ground being covered with a very prickly plant, which greatly resembled furze in its withered state; this shrub was almost black, seeming as if burnt, and the leaves were so much parched from the arid wind of Tartary, that they might be ground to powder by rubbing them between the hands.

The brownish tint of the furze, together with the bleakness of the country, have the appearance of an extensive heath, and would strongly remind a Scotch Highlander of his native land. Our course from

Brooang was about N. E., here we found we had reached the northern point of the Sutlej in latitude 31° 50′, it lay about two miles upon our left hand, and from this place its direction all the way to its source in the celebrated lake of Mansurowur is nearly E. S. E.

The wind was so strong, that we could with difficulty keep our feet, and it is said to blow with almost equal violence throughout the year. We saw some snow on our right a little below us, and beyond it a peak above 20,000 feet high, off which the snow was drifting in showers, from the force of the wind. From the pass to camp, the road was a moderate descent upon gravel, winding very much.

Shipkè is a large village in the district of Rongzhoong, under the Deba or Governor of Chubrung, a town, or rather collection of tents on the left bank of the Sutlej, eight marches to the eastward. The houses here are very much scattered, and are built of stone with flat roofs, there are gardens before each hedged with gooseberries, which give them a neat appearance. This is a populous place; we counted upwards of eighty men, who on our arrival came to meet us, being the first Europeans they had ever seen.

The Tartars pleased us much; they have none of that ferocity of character so commonly ascribed to them; they have something of the Chinese features, and their eyes are small; they go bare-headed even in the coldest weather, and have their hair plaited into a number of folds ending in a tail two or three feet long. Their dress consists of a garment of blanket, trowsers of striped woollen stuff resembling Tartan, and stockings or boots of red blanket, to which are sewed leather shoes; most wear necklaces, upon which are strung pieces of quartz or bone; they have also knives in brass or silver cases, and all carry iron pipes of the same shape as those used by labourers at home, and the higher classes have them ornamented with silver; in common with the inhabitants of Koonawur, the greater part of them have a flint and piece of steel for striking fire, attached to their apparel by a metal chain. The women whose dress resembles that of the men, were literally groaning under a load of ornaments, which are mostly of iron or brass, inlaid with silver or tin, and beads round their necks, wrists, and ankles, and affixed to almost every part of their clothes.

13*th October*.—Halted. My brother took a walk of about a mile farther on, with the perambulator and pocket compass, for we did not think it advisable to use the theodolite in the presence of the inhabitants, knowing their extreme jealousy; he had proceeded a little way from the village before he was perceived, when immediately the people dispatched a couple of horsemen after him, and crowded round the tent, making a great uproar. My brother had begun to return before the horsemen overtook him; they told him they had come to bring him back, but seemed in perfect good humour, laughing whilst they spoke; they insisted upon his going before them, and would not dismount when he bid them.

About 9 o'clock, the Chinese Officers, of whom there are several to regulate the affairs of the country, brought sixteen seers of flour, which they requested us to receive as a present, and it was no unacceptable one, for our people had had but little food for the last three days. In the forenoon, the principal Officer shewed us a long piece of parchment, written in what we supposed the Chinese character, and gave us to understand it was an express order from the Garpan of Garoo, under whose authority the Debas are, prohibiting strangers from entering the country; he at the same time said, we had so many people with us, (having nearly 100,) that he could not oppose our progress, but it would cost him his head if he gave us the means of going on, so he would not supply us with provisions, which was the most effectual mode he could have adopted to stop us.

During the time we were at Shipkè it blew a complete hurricane, and the aridity of the wind dried up every thing exposed to it; the leaves of our books were more bent than I ever remember to have seen them in the hot winds, and no dew was observed.

The lat. of Shipkè by meridian altitudes of stars is 31° 48′, and the long. 78° 48′, its extreme height is 10,527 feet, and the thermometer ranged from 38° to 60°.

The people are affable and good natured, and allowed us to handle their pipes, knives, &c.; they thronged round our tent from morning till night, and we found it the most difficult thing to understand them even with the aid of interpreters, for the Koonawur words we had picked up, which were of the utmost use to us during our tour, were not intelligible here. This evening the articles that had been so long in the rear came up.

14th October.—At sunrise, when the thermometer was 31°, and before the inhabitants had risen, I set up the theodolite and took the bearings and altitudes of the remarkable peaks; one of them covered with snow above 20,000 feet in height, is only 4 miles from the village from which it subtends an angle of 28 degrees; another called Tuzheegunj, 22, 488 feet high to the north of the Sutlej, was seen under an angle of 23° 31′, these elevations were observed with the sextant and artificial horizon.

We exchanged a gold button for a goat, which we took with us to Soobathoo; the wool is extremely fine, and almost equal to what is used for the manufacture of shawls; we were informed the best was procured further to the eastward near Garoo, which is the famous mart for wool. The goat scarcely differs from the common one, and it does not appear to be a distinct breed that produced the shawl wool, but its fineness seems to depend almost entirely upon the elevation and coldness of the climate. We ourselves had an opportunity of seeing this at Soobathoo, 4,200 feet above the sea, the wool is little better than in the plains of Hindoostan, but it gradually grows finer as you ascend, and in Koonawur, where the villages are more than 8,000 feet high, it is fit for making coarse shawls.

Garoo or Gartop, by the accounts of fifteen different people, is reckoned 11 marches from Shipkè, and the road consisting of gentle swellings, is described as being so good, that the trade is carried on by yaks.

After breakfast, we returned to Numgeea by the same road as before, and on the 15th of October struck off to the N. W. towards Ludak, crossing the Sutlej a mile from the village by a crazy bridge, constructed of ropes made of the bark of a tree, with basket-work of twigs forming a curve almost the sixth part of a circle. The breadth of the river was 74 feet, including a large rock in the middle occupying 42 feet, the extreme height of the bed is 8,600 feet. This day we travelled 7½ miles, passing over a mountain of 13,186 feet, the ascent of which was very steep upon rugged rocks, and above 4,500 feet. We encamped near a stream at the height of 12,800 feet, and had but a small supply of fire-wood, the country producing nothing but the prickly bush before-mentioned, and another not unlike broom.

16*th October*.—Seeing high mountains to the eastward, which appeared to be practicable, and thinking the distance short, we resolved to attempt them whilst our baggage proceeded direct to Mako, only about 3 miles from our camp. We accordingly set off after an early breakfast, and went up the face of a steep hill for 1½ mile, sometimes over large misshapen masses of granite, sometimes upon a gravelly soil covered with brown furze and various kinds of aromatic shrubs. There was not the least trace of a foot-path, and the prickly bushes impeded us not a little, every moment running into the feet through the shoes which were of the kind used by the natives, our own stock, from the badness of the roads, having been long since worn out. The height of this station was 14,900 feet. There being another higher peak without snow that seemed near, we moved towards it, but were never so much deceived in distance, it took us full three hours to reach its top, and the ascent was very tiresome, lying over enormous detached blocks of stone, often resting upon small bases, tottering under the feet, and seeming ready to overwhelm us ; the last 200 yards were still worse, and we were obliged to use both hands and feet, now climbing up almost perpendicular rocks, and now leaping from one to the other ; a single false step might have been attended with fatal consequences, and we had such severe headaches, and were so much exhausted, that we had hardly strength sufficient to make the effort, and it required no inconsiderable one to clear the deep chasms which we could scarcely view without shuddering. I never saw such a horrid looking place, it seemed the wreck of some towering peak burst asunder by severe frost. After much delay, we got up the theodolite and a couple of barometers, at 4 P.M. the mercury stood at 16.170 inches, and the thermometer was 29°, which compared with corresponding observations made at Soobathoo, gives the height 16,921 feet. We observed all the surrounding peaks, and then proceeded to the village of Nako at a quick pace, the road for the first mile was a steep and rocky descent, afterwards a more gradual one to camp, where we arrived at dusk. The distance by perambulator was ten and half miles, but we must have travelled upwards of eleven, for the wheel could not be rolled to the top of the highest peak.

17th October.—From what we saw yesterday, we were convinced we could reach a more elevated spot, and thinking the attainment of a great height more desirable than a high latitude, we resolved to try it again, and rather defer our intended journey towards Ludak, than let slip such a favourable opportunity. From our experience of the slowness with which the perambulator can be rolled over the large stones, we sent it together with the large theodolite a-head at 8, and moved ourselves at 10. The road at first was tolerably good, lying upon turf and passing some lakes which were frozen over, latterly it was rocky and the ascent fatiguing, but not near so difficult as yesterday's. We stopped several times to look out for our people, but not seeing any sign of them, we dispatched a man to Nako with orders to bring our bed clothes, a few bundles of fire-wood, and some food to meet us, whilst we proceeded on to a kind of break between two peaks. The last half mile was generally over snow, and both my brother and I felt completely debilitated, and were affected with severe headaches and pains in the ears; the highest vegetation we saw was a plant with leaves like sage, but without smell, it grows at the height of 17,000 feet, beyond which elevation we found no soil. At the top of our station between the peaks, the barometer shewed 15.075 inches, which gives the height 18,683 feet. The thermometer when first taken out of the case was 30°, but in less than a quarter of an hour, it fell to twenty-two degrees below the freezing point. After taking a few bearings, with all possible haste, we set out on our return, and at dark met our servants with our bed clothes 1½ mile from Nako, and halted for the night at the height of 13,724 feet without a tent. Our people had brought wood, but not flint to strike a light, we therefore sent them back to the village for some fire. It was past 11 before they returned, and during an interval of near 5 hours, we sat shivering with cold, for the thermometer was 6° below the freezing point, and we had only a couple of blankets each to wrap round us. After we had lighted a fire, we made a large quantity of punch, which we continued drinking till near two in the morning, and I do not recollect any thing that ever refreshed me so much.

The length of our march to-day was about ten miles, and we ascended 6,800, and descended 5,000 feet perpendicular height. The people with the perambulator and theodolite missed the way, and did not arrive till midnight, and their hands and feet were almost frozen.

18th October.—The thermometer at sunrise was 16°, and the cold intense, we could not sleep much owing to it, for excepting a few sticks which we kept for the purpose of preparing breakfast, our firewood was exhausted.

We wished much to see the barometer below fifteen inches, and determined to make another attempt to reach the summit of a peak north of our yesterday's station, which appeared 600 or 700 feet higher. Being now one and a half miles nearer to it than before, we had every hope of succeeding, so sent off the articles we required there as soon as we could prevail upon our people to move, which was not, however, before 9 o'clock. We were well equipped with instruments for making all requisite observations; we took three barometers, two thermometers, a large theodolite and a small one, a perambulator, a telescope magnifying eighty times, and a smaller one, together with a bundle of sticks to try the boiling water, and a sextant and artificial horizon, with us. We marched a little after ten, and overtook our people not a mile from our halting place; we had infinite trouble in getting them to go on, and were obliged to keep calling out to them the whole way, at one time threatening, and at another coaxing them; to tell the truth, however, we could not have walked much faster ourselves, for we felt a fulness in the head, and experienced a general debility, which together with headaches and pains in the ears and breast, affected us more than the day before. A cold wind that benumbed our hands sprung up, and increased with our height till about 3 P. M., when it died away. After much annoyance, we reached the place where we put up the barometer yesterday, here the man who carried the bundle of sticks sat down and said he must die, as he could not proceed a step further, and neither threats nor the promise of a handsome reward could induce him to move; we accordingly left him, and after an ascent of 700 feet, attained the top of the peak, 19,411 feet above the level of the sea. The road latterly lay over disunited blocks of granite, between which we found large lumps of ice transparent as crystal; we got up the last ascent without much difficulty, which is somewhat surprising. It was 4 P. M. when we gained the summit, so we had no time to make half of the observations we wished; the thermometer was not below twenty-two degrees, but from the wind on the way up, our hands were so numbed, that it was not until we had rubbed them for sometime that we got the use of them. Whilst I was setting up the large theodolite, my brother tried three excellent barometers, which we had the satisfaction to see stand exactly at the same point, 14,675 inches. The Turheegung mountain had an elevation of seventeen degrees, and was not more than two miles distant; the ink froze, and I had only a broken pencil with which I got on very slowly. It was twenty minutes to five before we had finished our observations, the thermometer was eleven degrees below the freezing point, the cold increasing every instant, and we had 7,600 feet to descend, over a bad road, in a distance of six miles. We cautioned our people against delay, and moved downwards as fast as we could walk; we passed the bundle of sticks where it was left, but the man had disappeared, and we next day understood he had reached camp before us. Night overtook us two and half miles from Nako, and my brother had the misfortune to fall and hurt his leg so much, that we greatly feared he would be obliged to remain where he was until assistance could be obtained from the village; after sitting down for half an hour, he found himself able to proceed at a slow pace, so we moved on, and shortly after lost the road by going too far to the right. We got in amongst a confused jumble of gigantic masses of rock, from which we found it no easy matter to extricate ourselves; we wandered about amidst them almost as chance directed for one and half-hours, many of the stones shook under us, and we passed places frightful even in daylight. About nine we espied a light below us, and heard the roaring of the Lee river, which seemed quite close; it being then calm, this made us imagine we had gone beyond the village, but judging from the strange structure of the surrounding mountains which we could scarcely mistake, we thought it impossible we could have done so, more especially as we had seen no cultivation, and there are a good many fields around Nako; we therefore went on and arrived at a Lama's temple that we recognised about a quarter of a mile from camp; we called out, and were answered by some of our people, who came to meet us with a couple of lights. We reached camp at half-past nine, not so much tired as might have been expected; only four of our servants arrived that night, the rest stopped without firewood at our former halting place, and came up late next day, having their feet so much swollen by the frost, as to be unable to carry loads during the rest of our journey. The distance to-day was ten and a half miles. Our last three marches were fraught with accidents; three barometers, a perambulator, and thermometer were smashed in pieces, and the small theodolite, a very neat instrument by Dolland, was rendered unfit for taking elevations, the nonius having been broken off; we had remaining two theodolites, a surveying compass, four barometers, and as many thermometers, a strong perambulator, a couple of sextants, a reflecting circle, a repeating one, and a chronometer, so we were still very well supplied with instruments.

We had great reason to be thankful, that during these last three days there was very little wind, and none at all when we visited the highest peaks, for had there been any when the thermometer was so low, it must have chilled us, so that we could not have moved, and to have remained at such heights for a night, would have been almost certain death.

19th October.—As many of our servants were unable to walk, from fatigue and sore feet, we halted. The village of Nako is situate about a mile to the east of the Lee river, and is the highest we met with during our tour, being not less than 11,850 feet above the sea; it is pretty large, and inhabited by Lama Tartars, rather different in appearance from those at Shipkè, and not so much resembling the Chinese; there is more cultivation about it than would be expected considering its elevation, the fields which are chiefly wheat and a kind of pulse, extend to the height of 13,000 feet, and have stone dykes around them; yaks are used here in the plough, they are hardy animals, but often vicious. The grain produced, as at most other villages in Koonawur, is insufficient for consumption, and the people subsist by their flocks; there is a pond near this, surrounded by apricot trees, upon which in winter the boys amuse themselves by sliding, but they do not know the use of skates.

This morning the thermometer was eighteen degrees below the freezing point, a shower of snow had fallen upon the adjacent mountains, and every thing indicated the sudden approach of winter; it was now time for us to think of returning, so we decided upon going no farther than Shealkhur. We here received a visit from the Wuzeer Loktus, who has charge of Hungrung, one of the subdivisions of Koonawur, containing ten or twelve Tartar villages, which lies on both sides of the Lee river from Shealkhur to the Sutlej; he came here to collect the revenue, and brought us a couple of *chowrees*, and some fine purple grapes from Soongnum.

20th October.—Marched to Chango nine miles, the road was in general good and broad, lying about a mile from the left bank of the Lee river; we found a great deal of red clay at the height of 12,000 feet, and above the hills, were of granite and gneiss. Chango is situate on a pleasant spot between two rivulets near the Lee.

21*st October*.—Marched to Shealkhur, a fort and village belonging to Busehur, under charge of Loktus; its distance from Chango is three and half miles; the road was rocky upon the left bank of the Lee, until under the village, where we crossed it by a bad wooden bridge, the bed of the river is here 10,000 feet above the sea, and the breadth of the stream 92 feet; but it is not nearly so deep or rapid as the Sutlej.

The fort of Shealkhur is situate in latitude 32°, and longitude 78° 38′, upon the confines of Ludak and Chinese Tartary; it is in a most ruinous state, and the village is a poor place.

The first Ludak village was said to be a day's march to the northward, but as a single fall of snow might have shut the passes, we gave up the idea of visiting it.

From Koonawur to Garoo there are three roads, one from Shipkè has already been mentioned, another from Shealkhur not so good as the former, lies through Choomoortee, an elevated country under a Deba, where the people dwell in tents, do not cultivate the ground, but subsist by their flocks; the third road from Nisung crosses part of the Himalaya range at a pass called Gangtung, which is represented as being extremely difficult. It is worthy of remark, that the Koonawurees estimate the height of mountains by the difficulty of breathing they experience in ascending them, which, as before noticed, they ascribe to a poisonous plant, but from all our enquiries, and we made them almost at every village, we could find nobody that had seen the plant, and from our own experience, we are inclined to attribute the effect to the rarefaction of the atmosphere, since we felt the like sensation at heights where there were no vegetable productions.

The traders who cross Gangtung Pass put on so many clothes to defend themselves from the excessive cold, that they can scarcely walk; they wear a large garment with sleeves reaching almost to the feet, made of sheepskin with the woolly side inwards, trowsers and stockings of the same material, a kind of rude gloves of very thick woollen stuff, and caps and shoes of blanket; they likewise occasionally wrap three or four blankets round them, and thus accoutred, set out on their perilous journey. No herbage is met with on the way for two days, and travellers are said to have dreadful headaches, and pains in the ears even when at rest; many goats and sheep die annually, and it is no uncommon thing for the people that attend them, who also sometimes perish, to lose their fingers and toes. This road leads past Chubrung, and crosses the Sutlej at Chuksum *Sango*, a wooden bridge with a railing of iron chains, under Tooling a large collection of tents, where there is a temple with a gilt cupola roof held in great repute amongst the Lamas. Leh, or Leo, the capital of Ludak, on the right bank of the Indus, is reckoned sixteen day's journey from Shealkhur. There are several roads from Koonawur to it, one from Wangpo, another from Soongnam, and two from Shealkhur; they are rocky at first, but afterwards improve. Leo is about midway between Kashmeer and Garoo, being eighteen marches from either.

22*d October*.—Proceeded to Lee, a village on the right bank of the Lee river, near the junction of a small stream with it. The distance is twelve miles, and as it was late when we started, we did not reach it until upwards of an hour after dark, and half our baggage did not arrive that night. The road was bad, crossing two rivulets, the ascent from the latter of which was extremely tedious and dangerous, being very steep upon sand and gravel that seemed to have but lately fallen; it was a natural slope, and much caution was requisite to avoid putting the loose earth in motion, for there were no marks of a foot-path; with all our care, however, it was not unfrequent to slip back many yards, and sometimes near a hundred feet of sand gave way at once, carrying the traveller with it, but not very quickly; the greatest danger arose from stones displaced by our people who were a-head, which every now and then whirled past us with astonishing rapidity.

23*rd October*.—Marched seven and a quarter miles to Hango, situate on the bank of a stream flowing to the eastward to mix its waters with the Lee. This valley contains five or six villages, around which there is more cultivation than we had often seen in Koonawur. The road commenced with a steep ascent of 2,500 feet, and then was good and even to Hango, 11,468 feet above the sea.

24*th October*.—Marched to Soongnum nine and a quarter miles; at first we had an ascent of 3,400 feet by a good but steep road to the top of Hungrung Pass, 14,837 feet in height; this pass separates Hungrung from another of the divisions of Koonawur, named Sooè or Shooung, under the Wuzeer Budreedas; the mountains immediately on either side might be fully 1,000 feet above us, but there was little snow upon them, and none at all in the pass itself. The wind blew with irresistible violence, and although the thermometer was four degrees above the freezing point, it chilled us so much, that the numbness of our hands continued almost until we reached camp, to which we descended by a good broad road cut into long zigzags, and crossed by some rivulets entirely frozen.

Soongnum is a town of considerable extent and beauty, it is situate on the point under which the Darboong and Bonkeeo unite, the former is a stream of some size, and comes from the N. W., the latter is small, and has its source near Hungrung Pass. The dell through which the Darboong flows is broad and level, and almost an entire sheet of cultivation for about three miles; it is a beautiful spot, and the extensive vineyards and number of apricot trees have a fine effect; it is shut in to the north and south by mountains not under 14,000 feet, to the N. W. is a steep and high pass to Ludak, and on the eastward lies the Sutlej, which the Darboong joins under the village of Sheasoo, four or five miles further down the glen.

Soongnum is inhabited chiefly by Lamas, and its extreme height is 9,340 feet. Trees which we had not seen since we left Numgeea, appeared in this vicinity thinly scattered upon the surrounding mountains, they consist of keloo or kelmung and ree, both varieties of the pine; the last kind which produces the neoza almond in shape, resembling the pistachio nut, and in taste not inferior, is peculiar to Koonawur, and does not grow to the westward of the Buspa or Wangpo rivers.

In the evening we were entertained with a Lama concert, which was far from disagreeable, the music was high and low alternately, one set singing the bass and another the treble.

25*th October.*—After crossing the Darboong by a good *sango* we marched to Lubrung, a distance of ten and a half miles; the road was good, winding very much, and crossing the Roonung Pass, 14,508 feet high, at the top of which the wind was as strong and cold as yesterday. We found a great deal of juniper on the way, and the berries were large and well tasted, having little bitterness.

Labrung is a large village upon the right bank of a rivulet called Zong, a couple of miles from the Sutlej, and 9,296 feet above the sea; opposite to it, and a mile distant, is the populous town of Kanum, where the Wuzeer Loktus resides during winter; there are two brothers, named Buleeram and Busuntram, but they are both generally called Loktus, which word properly speaking, should be applied to their house, a building of great extent.

26th October.—Marched to Leepè six and a half miles, the road was bad, lying upon sharp rocks. The houses here, as well as at Labrung, are wholly composed of wood, they are small, and in shape exactly resemble cisterns. Leepè consists of an upper and lower division, both of which contain a good many inhabitants; it lies upon the left bank of the Tetee, a large stream, having its source amongst snow twelve or fifteen miles to the N. W. The vineyards are numerous, and the grapes large and of a delicious flavour.

27th October.—Marched to Akpa ten and three-quarter miles. The road was rocky, passing the village of Jangee, and for the last four miles led through forests of pine upon the right bank of the Sutlej, about a mile from the stream.

28th October.—Proceeded to Pangee ten and three-quarter miles. The footpath was rugged in the extreme, lying a great part of the way upon fragments of granite and gneiss, which appeared to have but lately fallen, and exhibited a heap of gigantic ruins, amongst which we saw many a noble pine lying prostrate, whilst a few with their branches broken off and otherwise disfigured, just barely peeped above the stones. Large portions of rock fall yearly, and their effects are truly dreadful, they sweep every thing with them, and sometimes stop the channels of the largest rivers for weeks.

From Leepè to this place there is a direct road not exceeding fourteen miles, but we chose to go round by the Sutlej, in order to have a better view of the Kylas peaks.

29th October.—Marched to Rogee nine miles. The road was first a very steep descent of 1,000 feet to the Mulgoon, a large stream descending at a considerable angle, rushing over rocks with rapid force, and forming a series of cascades; we crossed it by a couple of *sangos*, the current being divided into two; the ascent from it was fatiguing for a mile, the road then for the next five miles was excellent, leading upon soil through woods of pine, the trees of which attain a large size, but not quite equal to those near Brooang, one of which measured thirty-three feet in circumference; the last one and half mile was of an extraordinary nature along the brink of a tremendous precipice, and often upon unsteady scaffolding that has been constructed with very great labour, this continues for several hundred yards together, and is formed of spars driven into the crevices of perpendicular faces of rock, with their other ends resting upon trees or posts and boards across. Now and then you meet with a rude stair of wood and stone, which must have required much trouble to erect; the rocks project above the path, and the traveller is frequently obliged to stoop in order to avoid them, whilst at the same time he must pay equal attention to his footing.

Part of the road was destroyed last rainy season, and had not upwards of twenty people been early sent off to repair it, we should have been forced to go by the Sutlej, which is nearly a whole march round; by the time we arrived at the place that had given way, they had made several clumsy wooden ladders, which answered our purpose tolerably well. The mountains latterly on either side of the river are craggy, rent in every direction, almost destitute of soil, and thinly wooded, but in the vicinity of Kushbeer, which we passed half way, the ground slopes gradually to the Sutlej at some distance, and is thickly studded with hamlets and adorned with vineyards.

There are several orchards belonging to Rogee, which contain apples of an excellent kind, nearly as large as those brought from Kabool, which they far excel in flavour.

30*th October*.—Proceeded to Meero eight and half miles. The road was very uneven upon angular pieces of quartz, gneiss, and granite, often bordering upon a precipice about a mile from the Sutlej, here called Sumudrung. The rocks on our right hand were of the same cracked appearance as yesterday, frequently overhanging the path, and menacing destruction to the left; towards the river the declivity is more gentle, and generally clothed with pines, unless where they have been buried amongst rocks dislodged from above.

Meeroo is situate in the district of Rasgramee, and is 8,550 feet high. Besides the subdivisions of Koonawur already noticed, there are three more, Utharabeesht on the southern bank of the Sutlej to the westward of Brooang, Pundrabeesht opposite it on the north side of the river, and Wangpo, containing only seven small villages to the N. W. of Meeroo.

31*st October*.—Marched seven and three-quarter miles, and encamped near a cave close on the right bank of the Sutlej. The pathway was indifferent, ascending and descending alternately, and passing the village of Chegaon or Cholang, pleasantly situate near a stream five miles from Meeroo; half a mile on this side of it the road led through an arch formed of two stupendous rocks of granite, which meet at an angle.

1st November.—Marched to Nachar eight miles. The way was rough for four miles to the Wangpo, a large mountain torrent that rushes down a steep declivity, forming a succession of waterfalls in its course, and dashes against the huge masses of rock in its bed with a noise like thunder, throwing up the spray to an amazing height; we crossed it by a good *sango*, and proceeded half a mile upon level ground to Wangtoo Jhoola, a rope bridge over the Sutlej; it consists of five or six cables close together, upon which is laid half a hollow fir tree, about two feet long, with pegs driven through it to prevent its coming off; from this hangs a loop of three or four ropes in which the passenger takes his seat, it is pulled across by two pieces of rotten twine, that from constantly breaking occasion this to be a tedious mode of transporting baggage. The conveyance is a pretty safe one, but greatly alarming to a novice, for the Jhoola is elevated twenty feet above the stream, which runs with great rapidity and a deafening noise. Near this are the remains of a wooden bridge, such as described in Captain Turner's Narrative, that was destroyed on the Goorkha invasion of Busahir. We found the breadth of the Sutlej at the bridge eighty-eight feet, and the height of its bed 5,200 feet, in some parts it is scarcely fifty feet broad, and it was in attempting to swim over at a narrow place that one of my servants was drowned here last year.

After much delay, we got every thing across without an accident, and ascended for three and a half miles to Nachar, where there are a few grapes which seldom ripen; the degree of cold does not depend nearly so much upon the absolute height of the place, as its elevation above the bed of a river, for vines come to maturity upon the banks of large streams, 9,500 feet from the level of the sea, and Nachar does not exceed 7,000 feet in height.

2nd November.—Proceeded eight miles to Turanda in Utharabeesht, and three miles from the western limit of Koonawur. This day's march was beautiful, for the first three and a half miles upon soil and through shady groves of lofty pines, from twenty to twenty-seven feet in circumference, the road then was a rocky descent of one and a half mile to the Syldung, a rapid torrent dashing over large stones, and coming from the Himalaya mountains to the southward; we crossed it above the union of two streams by a couple of bad *sangos*, and then ascended from its bed by a rocky footpath, winding amongst extensive forests of oak, yew, pine, and horse chesnut to camp.

3rd November.—We were detained by a heavy fall of snow and hail, which lay around us in large quantities many hundred feet below the village; had this shower come on ten days ago, we should have been prevented from crossing the passes near Soongnum, which together with those above 13,000 feet, are blocked up for four months in winter.

4th November.—Marched to Soorahun thirteen miles. It took us almost the whole day to perform the journey, for the path which is at all times dangerous from often lying near a precipice upon smooth stones, by the late shower of snow, now frozen hard, had become so slippery, that we could get on very slowly.

We crossed four streams of some size, besides many smaller ones, they are all rapid, but of no great depth. The mountains near this are heavily wooded to their summits, the cultivation increases at every step, and the villages are most thickly scattered.

Soorahun is 7,248 feet above the sea, in Dusow, one of the large divisions of Busahir; it is the summer residence of the Rajah and most of his Wuzeers, who stay here six or seven months in the year to avoid the great heats at Rampoor; it contains several good houses, and a temple attended by Brahmins.

5th November.—Marched to Dhar nine and a half miles. The road was bad crossing the Munglad, a rapid torrent, by a rotten *sango*, consisting of two fir trees, about a foot apart, with small twigs and slates laid across, one of the spars is much lower than the other, and the bridge is both unsteady and unsafe; the descent to the stream was at such a great angle, that we frequently slid many feet at a time, the ascent was equally bad, lying upon pure mica, shining with a bright lustre, and extremely slippery.

6th November.—Marched to Rampoor, distant eight and a quarter miles. The road was sometimes rugged; but more commonly even; part of the way it was a complete swamp, lying through rice fields intersected by many rills.

Rampoor is situate in latitude 31° 27′ and longitude 77° 42′, on the left bank of the Sutroodra or Sutlej; although the capital of Busahir it is not near so populous as might be expected. There are several fairs here during the year, to which the Koonawurees bring blankets of various sorts, coarse shawls, wool, raisins, salt, borax and chowrees, and exchange them for wheat, tobacco, sugar, swords, &c. The houses may be about a hundred in number, they are large, well built, and covered with thick slates of a brownish colour, which form very heavy roofs; upon a few of the houses the slates are cut into oblongs, and laid regularly, which give them a neat appearance, but by far the greater number are of all shapes and sizes, and put on without any regard to order. Under the rajah's palace, a handsome edifice at the northern angle of the town, there is a rope bridge similar to the one at Wangtoo across the Sutlej leading to Kooloo, the breadth of the river is here 211 feet, and the *jhoola* is elevated thirty feet above the stream, which in the rainy season is said to come within four feet of it. In December and January when the river is at its lowest, people sometimes cross upon inflated skins. We found the bed of the Sutlej by barometrical observations 3,260 feet above the level of the sea.

The site of Rampoor is low and much confined, and one of the worst that could have been fixed upon, and from its being encircled by high mountains subtending an angle of between twenty and thirty degrees, a breath of wind can scarcely ever reach it; there is little soil and no wood upon the surrounding hills, and large portions of naked rock appear on every side of the town, which being once heated, retain their warmth for a long time, so that in summer the nights are not much cooler than the days, and from there being no circulation of air, the place for several months in the year is like an oven.

7th November.—Marched to Nirt upon the left bank of the river. The distance is twelve and a half miles, and the road for the first four and a half consisted of short rocky ascents and descents to the Nouguree, a large stream coming from the eastward; we crossed it by an excellent high *sango* with a railing, and the rest of the way was quite plain, lying near the Sutlej.

The extreme height of the bed of the river opposite to the village is 2,912 feet, and as this is the last place where we had an opportunity of measuring it, I shall now endeavour to give some idea of the probable height of Mansurowur Lake.

The Sutlej has a variety of names, being called Sutlooj, Sutroodra, Sumudrung, Sampoo, Langzhing-kampa, Muksung, and Zung-tee in different parts of its course; Sutroodra is most commonly used, by which name it is known from its source to the plains. In the Koonawur language, the words Sampoo, Sumudrung, Kampa, Muksung and Tee, all signify river. Zung means gold, and with the addition of the latter word is applied to the stream at a sandy place near Murung, where gold dust is found. By the accounts of many people who have travelled along its bank to its source, it issues from Lake Rawunrud, called also Rawathud and Lanka, which was confidently said by every body I saw that had been there, to communicate with Mansurowur, although Mr. Moorcroft could not dicover the outlet of the latter lake; the circuit of Rawunrud was represented to be no less than seven days' journey, but it is most likely both lakes were included.

From Nirt to Sundum Sango under Numgeea, the horizontal distance by the map is seventy-two miles, although by the road it is almost 140, the difference of level of the bed of the Sutlej in this space is about 5,690 feet, which gives the fall of the river nearly eighty feet per mile in a direct line, from Numgeea to Mansurowur, which is placed agreeably to Major Hearsey, (I fancy not far from the truth, as its position with regard to Shipkè agrees well with the accounts I received,) the horizontal distance is about 167 miles; if therefore only thirty-five feet per mile be allowed for the fall of the river from Numgeea upwards, it will give the extreme height of Mansurowur or Mapang Lake above 14,000 feet, and I am inclined to think this estimate rather under the truth than otherwise, for Mansurowur is unquestionably very elevated, from the circumstance of four large rivers, and perhaps five, taking their rise in that quarter.

1*st.*—The Sutlej issuing from the lake itself.

2*d.*—The Sind or Sing-kechoo, known likewise by the name of Sindke Kampa, has its source N. E. of Mansurowur. It is described as a very large river, and the principal branch of the Indus, being frequently called Attuk even near Caroo, three marches to the eastward of which it passes, running close south of the capital of Ludak, and three or four days' journey to the northward of the valley of Kashmeer.

3d.—The Tamjoo Kampa springs from the mountains east of Mapang, and at first flows towards the eastward.

4th.—The Manja-choo, or Kampa, rises south of Mansurowur and runs S.E. The latter two rivers I conclude to be the Bruhmapootr and Gogra.

I likewise heard of a fifth river (but only from the accounts of one person, which however I have not the least reason to doubt, as he travelled the road twice,) said to be crossed eight or ten marches E. N. E. of Garoo; its source is reckoned near Mapang, and it runs N. E., so is perhaps one of the great Chinese rivers.

8th November.—Marched eight and three-quarter miles to Kotgoor, where there is cantonment for two companies of the 1st Nuseeree Battalion. The road at the beginning of this-day's journey lay close upon the left bank of the Sutlej, and then was a steep ascent of 3,500 feet, latterly winding amongst beautiful woods of oak, yew, and pine.

10th November.—Proceeded seven and quarter miles to Kutoo, in order to make some astronomical observations, and get the bearings and altitudes of the surrounding objects. The ascent from Kotgoor is not less than 4,000 feet, the road at first was good, but afterwards steep and rugged. Kutoo consists of two small forts upon the top of a hill, 10,600 feet above the level of the sea, connected on the N. E. with the snowy mountains. The prospect from this spot is very extensive; upwards of fifty forts, with from four to six towers each, may be distinctly counted in the Rajships of Kooloo, Sooked, and Mundee, N. W. of the Sutlej, beyond these are seen high mountains covered with eternal snow; to the N. E. and East, appear the outer range of the great Himalaya chain, extending until it is lost in the horizon, whilst to the South and S. W. the hills decrease in height to the plains, which are clearly distinguishable at a distance.

We were detained here until the 16th, for we were involved in mist for several days, during which time we could not see half a mile on any side; the thermometer did not get above 34° in a house, with a large fire for two snowy days, and at sun rise was 28°, but when the clouds cleared away, it rose to 40° and 41° at noon.

After completing our observations, we returned on the 16th to Kotgoor, where we stayed a couple of days, and on the 19th marched to Jeemoo nine and half miles. The road for about four miles was generally good, passing many villages, and lying upon the face of a left hand range covered with dark forests of various sorts of trees to a small stream, from whence there was a steep ascent of 2,400 feet through a thicket to Nagkanda Pass, 9,000 feet high, here we found a great many hazel trees, but all the nuts were rotten; from the pass to camp, we had a moderate descent of three miles upon the slope of a grassy range that lay upon our right.

20th November.—Marched to Muteeana nine miles. The road for near six miles was good, upon the right bank of a rivulet, and crossed by many brooks to Mandunee, where there is a handsome temple built in the Chinese style; after leaving it, we crossed the Kuljehur, a stream coming from the northward that divides Koomarsaen from Keoonthul, two small states under chiefs called Ranas. Keoonthul is largest, and extends from Muteeana to the vicinity of Soobathoo. The descent to the Kuljehur was steep, and the ascent equally so, each about 1,000 feet. The mountains we passed are wooded with pines and oak in the vallies, but above produce little except grass.

22nd November.—Marched to Bunee fourteen and three-quarter miles. The road consisted of easy ascents and descents near the top of a range upon soil, and through a very highly cultivated country abounding with villages.

23d November.—Proceeded to Simla eleven miles, and next day made a forced march of twenty-two and a half miles to Soobathoo; the latter part of the road has already been described.

Throughout the above mentioned tour, the road was surveyed with some care, and a number of points were fixed trigonometrically, which agree well together; we were very lucky in having clear weather, and always managed to get two, but most commonly three or four meridian altitudes of stars, both north and south, contained in Dr. Pond's catalogue, at every halting place except one.

We had two sextants, and a Troughton's reflecting circle having a stand, with the last of which instruments the latitudes were usually observed. We carried no less than fourteen excellent barometer tubes with us, only two of which returned in safety. The mercury was revived from cinnabar, and was well boiled in the tubes, the last indeed was a most laborious business, for we broke upwards of a dozen of tubes in the operation. The most convincing proof that the air was entirely expelled, is, that the mercury in the tubes of thirty-two and twenty-six and a quarter inches stood exactly at the same point, although the vacuum in the short ones was not more than three-quarter of an inch, and on applying a candle to the top, the mercury rose a little, whereas had there been the least air, it must have sunk from the expansion, which would have been clearly perceptible in so small a space.

The largest theodolite was constructed by Troughton, and is graduated, both vertically and horizontally, to twenty seconds; the elevations of most mountains subtending small angles were taken with it, and those above ten degrees, were observed either with the sextant or circle and artificial horizon.

At every camp we tried the height of the boiling point with two good thermometers, which very seldom indeed gave the altitude of the place 300 feet different from the barometer, and had we arrived at our ground in sufficient time to distil water, I have every reason to think the disagreement would have been less, for wherever we had an opportunity of using snow, the coincidence of the two methods was most satisfactory.

The height of the colossal Tuzheegung, whose summit is almost 22,500 feet above the level of the sea, was determined by angles of elevation between four and twenty-four degrees, taken at eight different stations, varying from 9,000 to 19,000 feet in height, and from two to about thirty miles distant from it, and allowing one-fifteen terrestrial refraction, the extreme difference between any two of the observations does not amount to 250 feet. The Kylas Peaks, besides several others, were calculated from many stations at various distances, and none of them differ above 500 feet from one another. The next highest peak to the Tuzheegung is above 21,000 feet, it was seen from Hutoo fifty-three miles distant under an angle of 1° 47′, and its altitude deduced from this comes within 200 feet of what the observation at Rogee gives it, where the distance was eight miles, and the elevation about fifteen degrees.

The altitudes of our stations were calculated by M. Ramond's method above Soobathoo, where the barometer was observed five or six times a day during most part of our absence, and the height of the column was invariably measured from the surface of the mercury. By the mean of a whole year's barometrical observations, Soobathoo was found to be 4,205 feet above the level of the sea.

Memoranda on the Geology of Bundelcund and Jubbulpore. *By* Dr. J. Adam, *B. M. S.*

The following paper has been found amongst some old records, and it has been thought that its contents well entitle it to be rescued from oblivion. I am happy also to add that the collection to which it refers is now safely placed beyond risk of loss in the Society's cabinets. Being No. IV. of our Geological Catalogues.

The observations I have now the honour to lay before the Society, were originally intended to accompany a series of geological specimens, for the purpose of illustrating their relative positions and localities, or (according to the technical phraseology of the day) their *geognostic* and *geographic* situations, without a knowledge of which, no collection can be of much value. At the time, however, of dispatching these, I was still prosecuting a long march in a remote part of the country, and could not then command leisure sufficient to enable me to throw together the detached memoranda I had committed to paper in the early part of the route. Other circumstances afterwards interfered to prevent my putting this intention into execution, and it is only lately that I have been reminded of it, by finding in the Museum below, the collection to which the notes refer.

While, with all deference, I solicit the attention of my fellow members to the subject of the following pages, I must at the same time crave their indulgence for the imperfections in the manner of treating it, necessarily arising out of the scantiness of my materials. In moving along, from day to day without intermission, I could only take a very hasty survey of the geological features of the districts through which I passed, and was often thereby precluded from obtaining all the information desired. I trust also, they will make allowance for the want of interest inherent in such details. The objects of geology present little to allure a general enquirer; and indeed taken singly, may be said to be the least attractive that can engage the attention of mankind. A bare rock, or a clod of earth offers in itself nothing interesting. But when viewed in combination with surrounding objects, when contemplated in its relation to these, its local site duly considered—and the influence which it may exert in the mass on the animal and vegetable world; it then assumes a higher degree of importance, and the study will be found not only a pleasing one, but a source of great public utility. Observation pointing out the path, the geologist ascends from facts to inferences, gradually but surely; and though the way may be said to be long and wearisome, he obtains at length, in the great truths which it leads to, an ample recompense for all his toils. To trace the changes on the ever-varying surface of this globe; to compare the present with the past, and thus to study the history of its inhabitants in their several epochs of existence, from the shrub and insect up to man, the proud lord of all, constitutes the paramount aim of this research; while the discovery of new minerals, or their compounds, and new applications of them to the arts of life, stamp on his labours an additional value that they would not otherwise possess.

To qualifications leading to any such results, I have not the smallest pretensions, nor dare I aspire to the title of geologist from merely noting down a few simple facts and deducing the most obvious conclusions from them. Should the detail, however, prove the means of exciting those to prosecute the study of Indian geology, who possess greater ability and opportunities, I shall feel that my time has not been wholly misemployed. I need urge no stronger plea than this expectation for again bringing before the Society a collection apparently so little worthy their notice.

These specimens comprise all the rocks met with, between the Jumna and the Nurbudda, by the route of Banda, Lohargong, Bellary and Jubbulpore. They commence with the hills in Bundelcund, after crossing the Jumna at Chilly-terrah Ghaut. Between the hills and the river is situate a plain of considerable extent, the aspect of which differs so widely from that of the opposite country in the Dooab, as to merit particular notice. It may be observed, generally, that the soil of the plains of Hindostan *intra Gangem*, is a light coloured mould, consisting of a due proportion of argillaceous, siliceous, and calcareous earths, the last being most abundant above Monghyr. Its chief character is derived from the quantity of mica which it contains in minute grains and scales. This also prevails in the district I passed through from Allahabad to the Ghaut on the Jumna. About half a mile from this river we descend a bank, which at one time may have formed its boundary in the rainy season, and enter upon a low flat, where in place of a fair, shining, attenuated mould, the eye meets nothing but an uniformly dull coarse black earth, not unlike the half-digested soil of moss-lands at home. This dark soil is still more striking on the Bundelcund side, and continues almost the whole way to Besseramgunge. It seems to contain a larger proportion of argillaceous earth and vegetable recrement, than the lands on the left bank of the Jumna, and that generally observed in the Upper Provinces of India.

The Jumna, where the passage is made, is a smooth gently flowing stream. The banks shew no rock, but are high and perpendicular, and when viewed from the opposite shore along with the Kane, (which here joins its waters to the Jumna,) they look rather interesting, and are devoid of the dullness which characterizes the banks of the united rivers below Allahabad.

On approaching the town of Banda, distant two marches or about twenty miles from the river, several small hills are seen in the West, like erections for flagstaffs posted at regular intervals. They are of a conical, or rather pyramidal figure, and appear to run in one line from N. W. to S. E. One of these rises from the plain close to Banda. It is about three or four hundred feet high, and divided at the upper part into two or more smaller elevations, of which the central alone terminates with a pointed summit. The appearance of this hill from below is singular and fantastic; huge masses of stone presenting themselves in every position, and seeming quite unconnected the one with the other, while the few shrubs growing out from between them, serve as a contrast to the nakedness of the rock. On ascending the hill, we find this to be a reddish small-grained granite, having no regular arrangement, but lying in blocks of great size, some perpendicular, and others horizontal, with a convex or rounded surface in general. Many of these are scaling off; but the greater part remain perfectly entire, and possess more compactness of *integrant* structure than any rocks of the kind I have met with.

This hill at Banda may be considered to be the termination of the first of many series which traverse Bundelcund from W. to E., as no more are observed here. Following that line, soon after leaving Banda to the South, other hills come into view, and at first sight appear larger than the one at that place. This is chiefly owing to the effect of distance, increased by the dewy air of the morning; for on a near approach, we find these not to exceed the congeries at Banda, or the highest does so only on a small degree. Though evidently entering upon a mountainous country here, we are surprized to observe no general elevation of the surface; the same flatness of the plains continuing as on the opposite side of the Jumna, and the hills rising abruptly from a common level, like so many islands rearing themselves out of the ocean. They are, in fact, mere pictures on *dry* land of the rocky Madeira, Porto Santo or the Canaries, as seen in the voyage from England to India. At the village of Gerawah, twelve miles from Banda, we reached the second series. The general figure of these hills like the former mentioned is pyramidal, and they may be said in this respect, to resemble a fragment of the granite which composes them. They stretch from the village of Gerawah* in two or three directions, the line of some crossing that of others, and notwithstanding their irregularity as a range, they appear to follow individually particular series, and we can trace a succession of isolated rocky elevations, forming a sort of chain across the country. The largest of these situate to the right of the village, has at its summit a rock of a white colour like chalk, which I regretted the distance prevented me from examining. The others are composed entirely of granite similar to the rock at Banda, and present in general, the same deficiency of arrangement. There is, however, one apparent exception at the highest part of the hill immediately overlooking the village; *there* the piles have assumed the appearance of basaltic columns standing perpendicularly with four sides, and at a small distance, seem to be a superincumbent stratum of a different formation from the others underneath. On approaching as near as I could, I found the rock essentially the same however, but was at a loss to account for this peculiarity in its outward form. As I moved along the projecting blocks and ledges of this hill, I was particularly struck with the extreme heat which they retained. Although the sun had gone down some time on the opposite side, this was still so great as to be barely tolerable to the hand, and the atmosphere over them was proportionately elevated in its temperature.*

The country around here displays a thousand charms, compared with the district near the Jumna. The roads are dry, and the rocky elevation in front having a covering of beautiful shrubs entwined with every variety of climbing plant, which give quite a new feeling to the mind on viewing the prospect. New animals too, inhabitants of these, present themselves. The peacock arrayed in all Iris' gorgeous hues, and shining in his native plumage, is not unfrequently seen perched on a block of granite, while herds of antelopes bound along the plain below, and the shrill cry of the Indian partridge heard on every hand, first cheers the traveller with the opening day.

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* Sp. No. 1 to 3.

At Pungrawah,* the second stage from Banda, we findthe rocks on every respect similar to those described. In the march from Pungrawah to Kurtal, the next village on the route, a range of hills is seen in front, and on the left hand, much higher than any previously met with, and which, in place of the peakeds ummit, are crowned with a flat *table-land.* On one of the most conspicuous of those to the left stands the celebrated fort of Callinger. On reaching Kurtal, we still find peaked hills composed of granite, having the same characters as that at Bandah, Gerawah, and Pungrawah : and besides this, masses of a bluish coloured trap and large boulders scaling off in concentric layers. This trap rock appears to have been at one time extensive; and I could trace a superficial stratum over the granite for some way up the hill. What remains of it rests on that rock, without any distinct arrangement. The whole seems much affected by the operation of the elements, and it is probable, that from this cause a large formation has been removed and reduced to soil. Many of the granite blocks here are also fast going into decay, and the soil of the district adjoining is entirely formed from them. Its colour is sandy red, that of the felspar, and in this red sand, as a basis, are contained a great many small quartz crystals, which still remain entire, and unaltered in their structure. Chalcedonic pebbles are also found at the bottom of the hills at Kurtal, which appear to have been imbedded in a rock that had likewise rested at a former period over the granite. They possess the same characters as the pebbles found in the river Kane, that are so much admired on account of their beautiful variegated appearance and lustre when cut.

After leaving Kurtal, the road strikes into a wood of low trees, flanked on both sides by hills with flat summits; and for the first time we observe pieces of sandstone strewing the path, mixed with broken blocks of granite, and the more complete detritus forming the soil. On one hill, which is nearer than the others, we can distinctly see a horizontal position of the superior strata; and under the table face, a sort of projection enlarging the diameter of the hill, and gradually increasing to the base. The upper formation is evidently of the same nature as the detached pieces of sandstone found at the surface, while the great body of the hill is composed of granite, (and also perhaps trap,) similar to that of the pyramidal hills formerly described. Some *fuqueers*, or religious devotees, have taken up their abode on this hill, at the junction of the sandstone with the granite formation, and the face of their caves cut out of the solid rock, and *chunamed* over, with the elevated platform on which are placed the objects of their idolatrous worship, present altogether a very striking and conspicuous appearance from the plain below.

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* Sp. No. 4 to 8.

On passing the *fukeer's* hill, we came in sight of the eastern extremity of Adjeeghurh.* This fort like Callinger, crowns the summit of an isolated hill, and derives its principal strength from a *table-face* of sandstone rock. The sides of the elevation are covered with thick jungle, composed of beautiful low trees of every shade of green in their leaves, and of every size and shape, from the pinnated peaked leaflet of the tamarind to the broad expanded foliage of the teak, which, according to my knowledge of Indian dendrology, is very abundant in all these hills.

As far as my limited observation enabled me to determine, granite forms the great body of Adjeeghurh, and sandstone lies over it at the upper part, presenting all round a perpendicular face of rock to the height of between thirty and fifty feet, and constituting a natural barrier of defence, that of itself seems to render the place impregnable. The sandstone has a slight reddish tint, and is of the formation termed the old red sandstone Its position is perfectly horizontal, and its structure in general quite sound. The view from the ramparts of the fort displays well the peculiarity I remarked before, respecting the want of general elevation in the whole of this mountainous tract. Hills are seen in every direction covered with jungle, and rising abruptly out of an intervening flat country, the dull and cheerless aspect of which conveys to the mind the idea of an uninhabited waste, or the haunt of savage beasts only. It is precisely the expression Daniel has given in his delineation of a fort in the Mysore, where a sort of sombre stillness reigns, (if I may be allowed so to term it) that no language can pourtray. Adjeeghur and Callinger are no less interesting to the antiquary and mythological enquirer, than to the geologist; and the lover of arts will find abundant subject of admiration in the beautiful remains of ancient Hindoo architecture which still exist within the walls of both these forts.

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* Sp. No. 9 and 10.

The country for a short distance from Adjeeghur is open, and the soil which hitherto had partaken of the qualities of the prevailing rock, again resembles that on the other side of Banda. It is of a dark colour and soft, what by agriculturists at home would be termed *rotten soil*, the "*putre soliem*" of the Poet.

> " Nigra fere, et presso, pinguis, sub vomere terra"
> " Et cui *putre soliem*————
> " Optima frumentis ; non ullo exæquore cernes,"
> " Plura domum tradis, decedere plaustra juvencis."

A few miles further on, we came to the village or hamlet of Besseramgunge, beautifully situated at the foot of a wooded hill over which are the Ghaut passes to the upper district. This Ghaut leads from the low country of Bundelcund to the elevated table-land on a level with the hills last mentioned. The path is cut through, or carried over granite, trap, and sandstone. At first the ascent, though pretty steep, is not difficult, as there are few large stones, and no rock rising from the surface. Soon, however, it becomes steeper and more obstructed; granite, trap, and sandstone masses presenting themselves in succession, and in many of the last, may be perceived *quartz* nodules included, like those found in the sandstone of Table Mountain at the Cape. The arrangement of the sandstone is in general horizontal, but at some points it appears to rise from the surface, in the form of ridges almost vertical. The trap rock exhibits no well defined arrangement at the several points where it is found in the Ghaut; and I could not penetrate into the jungle here to examine the strata more extensively. It may, however, be inferred, that it is in every respect similar to that rock at Callinger, which I afterwards found lying chiefly in rounded masses of various sizes, occupying the middle of the elevation, and composing the greater part of it. These were in general mouldering at the surface, and many of the smaller boulders could be reduced to powder without the assistance of the hammer. The larger masses were more compact, and possessed great hardness. This rock belongs to the transition trap of Werner, to which class may also be referred that formerly met with at Kurtal, lying immediately over the granite of the peaked hills. The elevation may be altogether from 1,000 to 1,200 feet above the plain of the Jumna.

On reaching the top of the Ghaut, we cross one or two clear running streams, and some oozing rills and pools of stagnant water are met with, most of which indicate, by their blue slimy and iridescent surface, an impregation of iron in the adjoining soil. This is indeed composed of ferruginous gravel and reduced sandstone, and if we may judge from the luxuriant grass growing over it, it must be one of considerable fertility. The town of Punnah is distant about eight miles from the Ghaut, and the whole of the surrounding country here derives an additional interest from its being the source of the diamond. In my march thither, I passed several of the mines close to the road, but having resolved to halt a day at the town, I deferred my examination of them till the following morning.

Having started early next day, I soon reached the scene of operations, distant about three miles to the westward of the town, and in a situation corresponding to that on the other side. It was a thin jungle, with long delicate grass growing out of a reddish soil. The mines are mere narrow pits, four, five, or more feet deep, according to the distance of the subjacent rock from the surface, and dug out of a ferruginous gravelly soil, of a dark brown or blackish colour, like hepatic cinnabar.* It feels moist, and consists of fine sand, with a large proportion of small dark red and whitish, or *yellowish-white* pebbles, the former appearing to contain a large quantity of iron. When I arrived at the ground, two men were engaged in searching for the precious mineral, the chief of whom very readily replied to all my questions, and explained and exemplified the series of operations gone through. These are extremely simple. The soil,† as it is brought from the neighbouring pit, is thrown into a small square excavation in the ground, about two or three feet deep, the sides of which have been well beaten to prevent the gravel from adhering to them; a quantity of water being added, a man steps into the place with a small hoe and mixes the whole together, using his hands also for that purpose, and tossing away all the larger pebbles. This movement being continued for some time, the water is then thrown out by means of a small wicker

* Sp. No. 11. † Sp. No. 12.

basket, and carries with it the sand, leaving the gravel behind. After repeated application and discharges of water, the gravel is removed into another small basin of a circular figure, where it receives the last washing. From these it is conveyed to a large floor on the surface of the ground made of hardened earth, and there left to dry; the finishing operation consisting merely in a minute examination of this dry gravel, by a person acquainted with the external characters of the jewel in its rough state. Judging from the condition of the people employed, one would hardly believe that they could be able to detect a stone, but they assured me, they did so with the greatest ease, and it appears to be the transparency and lustre, even in this state, which directs them. The chief man picked out several pieces of transparent quartz from the gravels which he said resemble the diamond, "he had found them of "all colours and sizes, but the discovering of these, he added, did not "depend upon his own skill or exertions, it was altogether the "work of God,"—salaaming at the same time respectfully; and pointing with a most expressive manner to the heavens.

From the inquiries I made, diamond mining appears by no means a profitable concern at Punnah. Any one may dig, subject to paying the common duty of a fourth part of the produce to the Rajah, who is here, (as is the case every where else in Hindostan,) paramount lord of the soil. All stones, however, beyond a certain carat, are exclusively claimed by him; but it may be supposed, where the means of concealment are so much in the power of the workman, that the prince's treasury very seldom benefits by this source of revenue. In the farm or spot which I examined, two diamonds only had been found during the preceding year, and these fetched each 200 rupees. The number of workmen commonly employed, (in the various operations of digging, carrying, washing, and searching,) is from four to five, though I saw only two. Of these, the *sirdar* or chief, has a salary of five rupees per month, and the others have four, and when a valuable stone is found, some present proportioned to that, is generally made them by their master. So that after paying the duty and expence of working, it is obvious his gains in this instance must have been very small and not sufficient to induce him to persevere much longer in these operations. Indeed, the business of mining appeared altogether at a stand when I passed the spot; and judging from the remains of pits in every direction, it must have been carried much more extensively in former years than at present.

Red ferruginous gravel, the *matrix* of the diamond, may be considered as terminating the regular formations of the hills in this part of Bundelcund, the order from below being granite, trap, or basalt sandstone and gravel.

In taking a comprehensive view of these four formations as developed at the different sites mentioned, whether singly or in combination, we must at the same time consider the qualities of the soil in the intermediate and adjoining districts derived from them.

The prevailing soil in Bundelcund, and indeed all the way between the rivers Jumna and Nerbudda, is the black coarse earth already alluded to, consisting apparently of a larger proportion of clay and carbonized vegetable remains than is found in the lands to the north of the former stream. It retains moisture more perfectly than the common soil of Hindostan, hence its miriness in the rainy season, and its disposition to unite into masses, and form rifts and cracks during the dry and hot weather. Even in its driest state, however, it has not the stony compactness of pure clay soils, but when separated in small pieces from the mass, is found to be friable and easily reduced to powder. I think it probable, that this contains a proportion of magnesian earth, though never having subjected it to chemical analysis, I am not warranted in drawing this inference from any accurate data. It is reckoned exceedingly fertile, and the richness of the Bundelcund lands, where this soil predominates, is quite proverbial in India. From its quality of retaining moisture, the process of irrigation is not so frequently resorted to, and the labour of the husbandman becomes thereby lessened. Greater exertions, however, are necessary for preparing it for the seed, and in keeping it clear of weeds, than we see applied to the lands in Hindostan generally. A long grass, not unlike some of the troublesome varieties at home, was then springing up every where, at the time I passed through the district, and formed the only obstacle to the ploughing then going on in all directions.

One would imagine that the above characters of the soil would affect the atmosphere, and render the climate of Bundelcund moist and unhealthy. As far as my own observation extends, agues are very prevalent in the whole of the low country, and sometimes prove so severe in European habits, as to require a change of air for their removal, but the native population do not seem to suffer from any endemial diseases of this class in a greater degree than the inhabitants of other parts of India; and their appearance upon the whole, as presented to myself, was rather prepossessing, and indicated general good health and comfort.

This black soil has evidently been derived from the decomposition of some of the many varieties of trap rock, most probably amygdaloid or green earth, which appear to have rested at one time over the granite in the hills of Bundelcund. The trap rocks at Gerawah and Besseramgunge, and the globular variety observed on the hill of Callinger, may also have had a share in forming it. As I remarked before, many of the trap boulders are now in a soft state bordering on earth, and can be reduced to powder with the greatest ease. The soil immediately around, there can be no doubt, is formed from their *debris*, and as the plain in general resembles that, we may reasonably infer, that it also acknowledges a similar source.

Extensive forest, which it is not difficult to conceive had flourished here at no very distant period, may have furnished the vegetable matter; and the successive increase of a heavy moist soil covering the wood with each return of the rainy months, had prevented its complete decay. For the amelioration and improvement of such a soil in Europe, the agriculturist would have recourse to lime, as rendering it drier, and reducing the vegetable matter it contains to a state more fitted for supplying the requisite nourishment to the growing plant.

In India, however, such an expedient would not be attended with success, from the peculiarity which calcareous earth displays here of uniting into small masses, termed kunkur, and not mingling well with the other component parts of the soil, unless where siliceous sand happens to exist in an unusually large proportion. A mixture of this sand, either derived from sandstone rock or the *debris* of granite, and similar compound rocks, might be attended with the desired effect. We should certainly expect a favorable result from reasoning on the subject, but I am the more induced to think so from actual observation of another part of the same district, between Cullinger and Allahabad via Turrowa. There, a considerable change is indicated in the colour and properties of the soil. It becomes lighter as we proceed, and more attenuated; and seems to have been formed by the commingling of the alluvial deposit of the Jumna, with the black earth of the plain. Its fertility, if I may judge from the richness of the crops at the time I saw them, must be very great. The whole country towards the river presented one aspect of bountiful nature, and might well vie with the poet's "Gargara," in the ease with which it is cultivated, and the ample produce it yields the husbandman in return.

The appearance of the first hills in Bundelcund has been already described. It is quite characteristic of the granitic or purely primitive formation. Their outline, contrasted with the table-face and summit of those in the interior, exemplifies in a striking manner the effect of rock on the figure of mountains in general, from which we can often determine at the distance of many miles, the nature and position of strata forming extensive ranges. Hence too, we perceive the connection between geology and painting, and the advantages to be derived to the artist from an acquaintance with the elements of this science. The tops of the Himalya mountains, as represented on the splendid views of Mr. Fraser, may be inferred a *priori* to consist of granite from the mere circumstance of their form. They exhibit precisely the same outline, "*magna componere parvis*," as the isolated primitive hills in Bundelcund, but having their cliffs so softened by distance, as to present a uniform line at the various angles visible.

As to the manner in which the primitive hills in Bundelcund have been formed, it might seem presumptuous in me to hazard an opinion; the question involving in some measure the two grand theories of Hutton and Werner, that have so long divided the geological world. Yet it is impossible to contemplate the eminences at the same time with the ranges in advance, and not form some conclusion on the subject.

They appear to exhibit the *cores* of large hills, the exterior of which has suffered in the lapse of time; their more compact granitic interior still enabling it to resist the natural causes of decay. I think it most probable, that the whole of the district from which they rise, had at one time presented an uniform flat consistency of the three formations of granite, trap, and sandstone, in the same order as they are now found on the hills, and that some force from below had elevated the primitive rocks, causing also a disruption of the secondary strata.

Where this force was but slightly impressed, and on a limited area, a small elevation would be formed. The granite would then only break through the superincumbent strata, without carrying any part of them along with it, while the broken strata would rest on the sides of the mass after the impelling force ceased to act. The figure of the hill, then, would not be a pyramid which it now resembles, but would approach more to that of a core; sandstone, trap, &c. lying on, and surrounding the granite and filling up its inequalities, and the direction of the strata of each of these deviating, more or less, from the horizontal line in proportion to the elevation of the central mass.

We could thus picture to ourselves a hill more extensive than any of those now existing in the first series, the sides of which were composed of sandstone ledges, and the summit of a pointed block first, or mass of granite, or crowning the whole, may have been a table of comparatively small dimensions. Their original height in this case, may have been from thirty to fifty feet greater than their present, that being the average of the sandstone strata on the hills in advance. The process of reduction or diminution of bulk may be conceived to have taken place in the following manner. The sloping sandstone being acted upon by the elements of air and water, joined to the heat of the sun, had first undergone disintegration. The sand thus produced, would be washed down by the torrents in the rains to the base of the hill, and there spread out and form soil. This operation being continued, in course of time the whole of the inclined sandstone would be removed, and the trap or other rock immediately beneath it, come to be exposed in its turn. From the same cause which acted on the sandstone, this would also undergo a change, and ultimately be reduced to soil, covering the *detritus* of the former as it was deposited. The small table on the summit, in the course of these operations falling into fragments and rolling down the hill, would be exposed to the same successive changes as the sloping strata, and thus after the lapse of ages, nothing remain but the central primitive granitic mass as it is now displayed, forming, to use an anatomical illustration, the skeleton of a body which once existed. Both the ranges then, (the peaked, or primitive hills, and the tabular,) have been produced by similar causes, and at one time have been composed of similar materials, the only difference arising from the size of the primitive or granitic base. The sandstone so often mentioned, and the ferruginous gravel lying over it, are of very frequent occurrence in what are termed the Vindhya chain of mountains, from the centre of Behar to Malwa. The hill of Chunar consists entirely of the former, and in the range to the south of that station, the gravel is met with, as I have been informed, in great abundance.

The same association is observed in Bundelcund, and all the way to the Nerbudda; so that it may be inferred from this connection subsisting between them, as well as their coincidence in chemical properties, that the one is formed from the other. In what manner the chalybeate impregnation has taken place is not very evident, nor the source from whence the metal has been derived; but there can be little doubt the gravel is a secondary formation of the sandstone rock, and one too in all probability going on in many situations at the present day. It is interesting, as being the *matrix* of the diamond, both in the old and new world, and much speculation is necessarily connected with it on that account. It would, however, be foreign to the object of this communication to inquire into any opinions not obviously suggested by the facts detailed, and nothing occurred to me at the time I examined the gravel formation at Punnah and elsewhere, that promised to elucidate the origin of this highly prized jewel.

In proceeding southward from Punnah, we very soon approach another series of small hills, or cliffs, that rise out of the table-land to the height of one hundred feet or upwards. These elevations are also flat at the top, and composed entirely of sandstone, in every respect similar to the strata at Adjeeghurh and on the Ghaut, of which indeed they are but a part. For eight or ten miles the road here ascends occasionally, and we seem to cross over a low ridge connecting the hills to the right and left. The soil in the whole of this course is formed from the *debris* of the sandstone rock. It is of a light red colour and very dry, imparting rather a pleasing character to the aspect of the country, as well from its own sensible qualities as the vegetable productions it affords.

It appears admirably fitted for the culture of the vine; and should this ever be attempted on a great scale in India, perhaps no better situation could be selected for the purpose, than at the bottom of these sandstone hills in Bundlecund. Near the village of Cuckurettee,* a slight descent occurs; and we again enter upon an extensive plain, whose soil resembles, in some degree, that of the country below the

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* Sp. 13 to 15.

Ghaut. Here for the first time, traces of ***limestone*** are discernible. These increase as we advance, and bring us at length to the great calcareous formation, at the military cantonment of Lohargong.* The first intimation I had of this new field of geological research, was the discovering several species of shells on the banks of a nullah at Cuckurettee, from which I inferred the near vicinity of calcareous rock; as it has been observed by naturalists, that the Testacæ are only met with in soils abounding in this elementary earth. Between Cuckurettee and Lohargong, pieces of rock are found at the surfaces, ***striated*** in an uncommon manner, and disposed into very thin layers. It appears to be a mixed formation of ***sandstone*** and ***limestone,*** the latter predominating; but whether it is extensive or not, I am unable to say, as the masses were quite solitary and detached, nor did I observe any projecting from below the surface.

At the cantonments of Lohargong the calcareous rock shews itself decidedly, and impresses a striking character on the country around.† It is quite near the surface, and in many places even forms it, having no earthy covering whatever. It is evidently a secondary formation, and as I afterwards ascertained, one of considerable extent. In a journey which I made from Saugor, I could perceive indications of it six or seven miles to the westward, and in the other direction it is found in combination with clay schists, as far the bottom of the Kopah hills,‡ distant twelve miles from Lohargong. This rock is not distantly stratified, (as far as it was possible for me to observe,) but lies on the same general level with the plain, having its denuded surface convex or slightly rounded off. It possesses great compactness, and exhibits no signs of disintegration. On the contrary, exposure appears to harden it, by communicating to the bare surface a sort of semi-crystaline, or ***stalagmitic*** crust.

From this arises I conceive the bleakness, and inhospitable character that pervades the district, the ground being little cultivated, and bearing only a ***reed-like*** grass. By reducing the lime to the quick state, and mixing it with the neighbouring soils, some improvement might probably be effected; and at all events, as far as a horticultural experiment may afford evidence, it seems worthy of trial by the residents on the spot. This calcareous rock is of a formation posterior to the sandstone, and it is not improbable, rests upon the latter.

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* Sp. 13 to 15. † Sp. No. 15. ‡ No. 16 and 17.

Casting our eye over the plain here, and surveying the hills that rise on each side, in a manner surrounding and enclosing it, we naturally conceive the idea of an immense basin that had at one time been filled with water, and formed an extensive lake. Some river, we may suppose, had burst through the hills to the south, and diffused its waters over the plain. These, as they gradually accumulated, would at length equal the level of the range on the northern side, and force a passage to the country below.

We should thus have a lake, like that of Geneva, with a river entering at one side, and passing out at the other. In process of time, the lake filling up by the deposit of alluvium and animal recrement, a contracted channel only would be left for the stream to flow in; while the earthy contents of the basin would gradually acquire the form and solidity which they now possess. What the mere aspect of the country suggests, may be said to receive some degree of confirmation from the circumstance of the Kane actually following the course here described. It issues from the hills to the south of the plain, and descends over the rocky barrier on the opposite side, hollowing out a channel in the stone as it proceeds, and shaping it into every variety of fantastic form. These *falls* of the Kane, as they are called, are situate a few miles off the direct route from Lohargong to Saugor, and distant about two marches from the former. They are well worthy the notice of the passing stranger, on account of the singular forms presented by the rock which receives the river, and conceals its course for many miles; the bed of the stream above the falls also abounds with beautifully variegated pebbles which admit of a high polish, and are much sought after for ornamental purposes.

The pure calcareous formation at Lohargong, succeeded by a scissile rock, is apparently consisting of argillaceous sand, mica and lime, and may be termed a *sandstone slate.* It divides with great facility into thin laminæ, and has a regular horizontal stratification, as is well displayed at the ford of the Kane near Kopah, where both banks of the river are composed of it. The only effect I observed this rock to have on the soil, was to render it less pervious to moisture; and thereby to cause the water to stagnate on the surface in the form of marshes and shallow pools, which were more general here than in the preceding district.

After fording the Kane, here about hundred feet wide, we reach the village of Kopah, and enter directly on the range of hills forming the southern enclosure to the Lohargong basin. These are of various heights, but though less striking in their aspect than the range of the opposite side, they often afford the most beautiful and romantic prospects. They are entirely composed of sandstone of the same general characters as that so often alluded to. I picked up some specimens with dendritic impressions on the surface,* and occasionally found a mass of a different shade of red marked with white dots,† but these varieties seemed to be quite accidental. The strata were horizontally disposed, with the exception of one or two points, where they shewed considerable dip. Many ferruginous pebbles are met with, which appear to contain a larger proportion of iron than the gravel at Punnah. They are of the same essential characters, however, and only differ in that particular in being rather larger. On the hill immediately above Bellary, they are found united together in great masses, exceedingly compact, and apparently quite indestructible by the operation of the elements. From Kopah to Bisseinee is a distance of eighteen miles; from Bisseinee to Jyenuggur ten or twelve; and from this last place to Bellary as much more. The whole of this tract is hilly, and presents nearly the same general features throughout. We cross many clear running streams with rocky beds, ascend and descend moderate elevations, and between these, occasionally pass over a grassy plain. Around Jyenuggur the country is cultivated, and a patch of corn may now and then be met with in the early part of the route from Kopah, but with these exceptions, it is a continued jungle all the way to Bellary. On descending to this plain, the country again opens to the view, and a large plain with trees scattered thinly over it is seen extending in all directions. Having travelled by night from Bellary to the next stage, Koreah, I could not observe the appearance of the intermediate country, which was nearly as flat as the low country in Bundelcund. Between Koreah and the town of Sehorra, we find a new formation altogether, consisting principally of quartz. Some of the rocks are pure quartz, and disposed in vertical strata. Others have a peculiar striped arrangements in the mass, and in colour, lustre, and compactness, are not unlike the limestone of Lohargong. On arriving at Sehorra, I found these two rocks composing a small hill on which the fort or *gurree* is built. They appear to be primitive blue slate and quartz lying in opposition,* and in almost vertical and very thin strata, each layer not exceeding four inches in breadth. In several of the schistose strata, the stone has metallic lustre, and may with ease be reduced to powder. The quartz shews nothing peculiar; it lies close on the slate in continuous strata, and veins or thin laminæ may be observed intermingling with schistus. It bears, however, but a small proportion to this rock. In some specimens, the slate is striped with variously coloured materials differing in hardness. The town or village of Sehorra, where these rocks are met with, is prettily situated on two or three small gradually rising eminences, having a good deal of open grass glade, terminated by mango groves, in such a manner as to give to the whole the air of an English scene. The soil of the district around is of the same black colour as that of Bundelcund, but more clayey. It is extremely fertile, and the appearance of the surface at the time I passed, indicated that great care was bestowed on it by the ryots. For miles to the south and west, not a spot could be perceived which was not cultivated, and laid out in square pieces, with an intervening low mud dyke, similar to the paddy fields of Bengal. Rice too appeared to be a common crop here.

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* No. 18. † No. 19.

A few miles from Sehorra, we cross the Hirn, a stream of considerable width which falls into the Nerbudda, a little to the westward. The bed is not rocky like the Kane at Kopah, but formed entirely of sand without any gravel or pebbles. At a sweet little village named Gosulpore, which rises out of the surrounding miry soil, like an *oasis* from the desert, we again meet with large masses of the ferruginous concrete.† It is here more decomposed than on the hill above Bellary, and the ground on which the village stands, has evidently been formed from its *debris*. The natives, I was told, reduce the rock to the metallic state, and in the neighbouring town of Punnahghur work it very extensively; but not being aware of this at the time of passing through the place, I could not make any enquiry as to the mode of accomplishing the reduction. I should reckon it of very difficult fusibility, with all the assistance which art can bestow. In the dark clay soil around Punnahghur is interspersed a good deal of the well-known calcareous concretion, termed kunkar by the natives. It does not seem to be so pure as that found on the banks of the Ganges, but contains a greater mixture of argillaceous earth. All these combinations of lime with the other elementary earths, are of a secondary formation, and are continually going on in such soils as abound in the former. It is not easy to say, how the process of union takes place, but it would appear to be dependent on the alternate action of the sun's rays and moisture, and to resemble very closely chemical, or electric attraction, as influenced by similar means. We meet with nothing like this calcareous concretion in the soils of Great Britain, as far as I am aware of, and whatever the cause may be which produces it, we may reasonably conclude, that its operation is limited to the hotter regions of the globe.

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* Sp. 20. † Sp. 22, 23.

Between Punnahghur and Jubbulpore, we cross a small river named the Periot or Praca, (as laid down by Arrowsmith,) the bed of which abounds in every variety of agate and siliceous pebbles.

Near Jubbulpore is a low ridge of granite rocks,* in general qualities resembling that of Bundelcund, but approaching more to the gneiss formation, and at present undergoing a rapid decay. The whole district here is rocky, and presents a fine field to the geological enquirer; but my short stay only permitted me to give a cursory glance around the cantonment. Directly to the south of these, there is a formation of *old red sandstone* that appears to have been extensively quarried, and exhibits the peculiarity of being arranged in vertical strata, contrary to the usual position of this rock. A large mass of a whitish clay rock, containing quartz pebbles, forms the base of the hills to the east of the plain. It has been washed down by rains to powder, and formed anew into a boulder or cake at the surface. It probably has been formed originally from the disentegrated felspar of the neighbouring primitive rocks. The ridge lying over it, to the north and east, presents the primitive outline, and I concluded, was composed of similar granitic blocks to those

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* Sp. 34, 35.

I had observed on approaching the town from Ramnughur. At Jubbulpore, we may be said to enter upon the extensive valley of the Nurbudda, the river being distant about four miles. It is a clear mountain stream with a rocky bottom, in width here not much exceeding the Kane, but greatly deeper at the time I crossed it in the month of October.

The rock of Tetwarra Ghaut, judging from detached pieces, seems to be a species of trap, and lower down the river, I was informed, passes over a formation of primitive limestone. Some blocks of this marble I have seen. It is of a pure white colour and close structure; and for all the purposes of the statuary might be reckoned not inferior to the celebrated Parian or Carrara. The natives, aware of its excellence as a material for sculpture, employ it in making images of their gods, and various ornamental appendages to their temples.

Report made by J. Mohl, *in the General Meeting of the Asiatic Society of Paris,* 31*st May,* 1841, *on the labours of the Committee during the six last months of* 1840, *and the six first months of* 1841, *translated from the French. By* Dr. E. Roer, *Librarian to the Asiatic Society of Bengal.*

Note by the Editor.—The publication of the following article, in which allusion is made in much too flattering terms to myself, might be considered presumptuous, were not my readers apprised of the feeling with which I peruse this complimentary notice. It is a just acknowledgment of the talents, the industry, and research of my contributors, and it is in this character only that I lay it before them. This Journal is solely dependent for its name upon those who contribute to it, and it will be gratifying to them to find, that their support has not been unattended by the applause of men of the highest literary character in Europe, recorded in the proceedings of a Society, which ranks among the most eminent of the Western world.

Though the past year has not been marked in the annals of your Society by any peculiar event, yet it must be considered as a fortunate one, as it has afforded a slow, but constant increase of your resources, relations and labours, the most evident sign of the life, and most certain presage of the continuation of a Society. Your Journal has been regularly continued, and has been the store-house of numerous labours. The contribution of memoirs, received by your Committee of the Journal, has been greater than usual, so that it will soon become necessary to increase the size of your periodicals, to meet the activity of the members of the Society. We ought annually to have three volumes of the Journal, and one volume of the Collection of Memoirs, and though the resources of the Society do not admit our doing so at present, we may hope to attain this object hereafter.

The Committee would have desired to lay before you the first pages of the Voyage of Schulz, but could not command time. You will moreover observe, from the account which is to be given to you of the state of your finances, that the printing of this work, too long time already postponed, does not admit of any further delay. The great expences we defrayed for the printing of the Chronicle of Kashmir and the Geography of Abulfeda, are covered by the kind assistance of M. Villemain, Minister of Public Instruction, and the resources of the current year will allow us to send to the press the Voyage of Schulz.

The Society has sustained severe losses during the past year, especially among the foreign members. Mr. Gilchrist died on the 8th January at Paris. Born in Scotland in the year 1759, he passed a part of his early life in India, studied afterwards medicine, embarked as ship-surgeon to Bombay, entered there the service of the East India Company, and was transferred to Calcutta. He devoted to the study of the Hindostani, which he acquired with rare perfection, living for some years in a Mahommedan family. His systematic mind suggested to him the idea of forming that dialect into a language, which in Dehli and Lucknow had gained a great elegance as the language of conversation and poetry, but which in other parts of India, like the Lingua Franca, fluctuated between the Persian and the provincial dialects of the Hindus. He fixed the Hindostani Grammar, published a very good Dictionary, and translated a number of English works into that tongue, to furnish to its students works in prose, which were entirely wanting in the Hindostani literature, by which he rendered a signal service to the East India Company, giving a common language to their army, and the means of its successful study to their officers. Lord Wellesley made him Professor at the College of Fort William, where he had many pupils to attend upon his instructions. He afterwards retired to Edinburgh, where he established a bank, and some time later to London to resume the teaching of the Hindostani, and he lastly repaired to France, where he was occupied to his death with his favourite theory of an universal language. He was rather distinguished for the activity than for the exactness of his mind, and for an ardent character, which threw him during his whole life into endless literary and political disputes, though he had a large fund of benevolence.

Another very distinguished member, the loss of whom the Society has to complain, is, Monseigneur J. L. Taberd, Bishop of Isauropolis, Apostolic Vicar of Cochin-China. Born at Saint Etienne in the year 1795, he took orders in 1818, and went two years afterwards as Missionary to Cochin-China, where he arrived in the year 1821, just at the moment when the position of the French missions in that country became involved in difficulties. The Archbishop of Adran, who in Cochin-China had exercised an almost royal power, expired, when the reaction on which the Anti-French and Anti-Christian party a long time since contemplated, forthwith broke out, and thence continued to rage with increasing fury until this day. Under these difficult circumstances, M. Taberd was elected in 1823, Superior of the Mission, and in 1827, Bishop of Isauropolis, and Apostolic Vicar of Cochin-China. The persecution having dispersed the Bishops of Cochin-China, he was obliged to remove to Siam to be consecrated. The king Ming-Menh, however, by fixing a price during his absence on his head, prevented him from re-entering his diocese. Then taking refuge to Pulo-Penang, he founded the Catholic College for the missions of Transgangetic India, and went from thence to Calcutta to print his Cochin-China Dictionary, the fruit of the accumulated labours of a large number of missionaries, which was completed by himself. The generosity of the Governor General of India, and of the Protestant Missionaries at Serampore furnished him the means of accomplishing his great undertaking. Some time afterwards, he was elected Apostolic Vicar of Bengal, but he could not discharge the functions of his new appointment, as he almost suddenly died on the 31st July 1841, and as he had not previously received his definitive nomination.

The year, the labours of which occupy us, has not been very favourable to Oriental studies, especially in Asia, where war has paralysed so many undertakings. These circumstances indeed will latterly turn out to the benefit of Oriental literature in Europe, because the more and more increasing political importance of Asia must naturally claim the serious attention of the European nations; but for the present, the literary progress in the small number of places where it has been developed, has been retarded. The presses of Constantinople, Teheran, Cairo and Canton, have produced nothing worthy of remark, and those of India, though not altogether unemployed, have been less active than formerly.

The Asiatic Societies have everywhere continued in their efforts to make known the discoveries in the languages and histories of the East. The Asiatic Journal commenced by the late Mr. J. Prinsep, is now edited by Mr. (Henry) Torrens, who conducts it with great zeal and ability. The Society of Madras continued its Journal with much regularity. The German Oriental Journal commences a new series, and the excellent Journal of the Geographic Society of London, becomes more and more a powerful ally to the collections, specially designed for the East. The number of these collections has been augmented by the Orientalia, published by Messrs. Juynbull, Roorda and Weijers. The first volume of these collections has appeared in Amsterdam; its destination is to become the organ of the excellent school of Leyden, which displays in its Asiatic studies, the same spirit of learning and of conscientious research, which has for so long a time distinguished the classic Philology of Holland. The Orientalia do not exclude any department of research concerning Asia, but they are more especially destined for the Semitic languages and literature. The first volume contains a Posthumous Memoir on the collective Nouns of the Arabs by Hamaker, and a Poem not previously published, of Montanebbi, edited and translated by Juynbull, and a continuation of the Catalogue of the Oriental Manuscripts of the Library at Leyden, by M. Weijers. I should perhaps mention also as a new Asiatic Journal, the one published by the Society of Jesu in Lyon, under the title of " Lettres du Madure," of which six numbers have appeared.[1] It is composed of Letters of the Missionaries of this order in the South of India. Though its chief end is to give an account of the state of that mission, yet it contains a mass of details on the customs of the Hindoos, and would undoubtedly find its place in the libraries of the learned, if the Society were to allow the sale of it.

Two new Asiatic Societies have been established during the past year, one in Paris, " La Société Orientale," whose principal object is to publish the monuments of art of the Asiatic nations, the other in London, under the name of "Society for the Publication of Oriental Texts." It is now constituted and has commenced its labours. It forms the necessary complement to the Committee of Translations, and we sincerely hope, that it may be favoured with the support of the learned men and of public institutions ; which is so necessary for the execution of its great and difficult enterprise, as there is no chance of its becoming popular. It cannot be too often repeated, that the publication of the most important Oriental manuscripts is the greatest and most urgent want of our studies. Only when the critical labours of the learned have passed over the master-pieces of every literature; when the press has facilitated the material use of books, and obviated the immense loss of time, occasioned by the reading of manuscripts; when it has diffused to all corners of Europe the materials which must now be searched for in some collections of manuscripts, only then can European intelligence really penetrate the East, and by disengaging the historic truth from the thick layer of fables and contradictions involving it, reconstrue the history of mankind. The accomplishment of this object is indeed far distant, yet the way to attain it is distinctly pointed out, and every year we advance a step to it.

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[1] Lettres des nouvelles Missions du Madure. Lyon, 1840, in 8vo. Vols. I. and II.

The number of catalogues of oriental manuscripts in the European libraries which are being published or prepared, may be considered as a very good idea for this purpose. The Bodleian Library at Oxford has a short time since finished the publication of its catalogue, fifty years ago commenced by Uri, and finished by Nicoll; it has been published by Purey.[2] It is a great and beautiful enterprise, worthy of this celebrated library. Mr. Prinsep, a short time before his death, edited in two volumes, the Catalogue of the Manuscripts of the Asiatic Library of Calcutta. Mr. Fleischer, to whom we already owe the Catalogue of the Oriental Manuscripts at Dresden, has also published that of the Library at Leipzig.[3] Mr. Brooset has edited in Petersburg the Catalogue of the Armenian Library of Edchmiadzin.[4] For a long time it was the regret of those who took an interest in the Armenian literature, that the treasures contained in the Library of the principal place of the Armenian hierarchy, were inacessible to Europeans. At last the influence of M. de Flahn, Imperial Commissioner of the Caucasian provinces, has obtained from Catholicus the catalogue of his library, and the Academy of St. Petersburg hastened to communicate it to the public. We there may observe, that the disasters which during so many centuries oppressed the Armenian nation, equally retarded the progress of their literature; for the library of Edchmiadzin contains only 181 manuscripts, among which there are a hundred, which treat about history or geography, while the others are works on theology or scholastic philosophy. M. Schott has printed the catalogue of the Chinese books of the Library in Berlin, which is a continuation of the catalogue presented by M. Klaproth.[5] M. De Hammer edited the catalogue of his splendid collection of Arabian, Persian and Turkish manuscripts, and also that of the manuscripts of the Ambrosian Library.[6] M. Fluegel has likewise inserted in the annals of Vienna, a list of new acquisitions of Arabic manuscripts, which the Royal Library of Paris has made during the last years. The catalogue of the oriental manuscripts of Tubingen is published by M. Ewald,[7] and M. Dulaunier has inserted in your Journal the list of the Malayan manuscripts of the Asiatic Society of London. Lady Chambers has given to the press the catalogue of the magnificent collection of Sanscrit manuscripts, which her husband had made in India.[8] This catalogue is one of the last works of Rosen, whom death has so untimely taken from the prosecution of his oriental studies. The Academy of Lisbon has been sometime occupied with the preparation of a complete catalogue of all the oriental manuscripts in the Libraries of Portugal, which is of an incalculable value to literature, as the long dominion of the Portuguese in various parts of the East must have enabled them to collect a great many manuscripts. The Academy of Portugal will honour your Society with the charge of publishing the catalogue. The British Museum, a long time since one of the richest depôts of oriental manuscripts, is about to publish the catalogue of its Syrian manuscripts, prepared by the late Mr. Rosen, and we dare hope, that this excellent institution will make known the rest of its treasures, which the want of a repository, as well as the existence of very annoying regulations, render of a difficult access. Lastly, your Society proposes to publish among the papers of Schulz, the catalogue of Arabic manuscripts relative to history, which are in thirty-two public libraries of Constantinople. It is extremely desirable, that not only large libraries, but also those which possess only a small number of manuscripts, as well as learned men, following the example of Sir W. Ouseley and M. De Hammer, print their catalogue for the purpose; that every one may be able to know what is to be found in Europe, and accordingly to guide himself in his publications, and especially, that Europeans settled in the East, in full knowledge of the existing wants, may procure manuscripts to complete the collections of the Western world, and may save important works from destruction. A vast number of works, which are considered as lost, are undoubtedly extant in some obscure libraries of the East, but we must hasten to obtain them, as every thing conspires to accelerate their destruction. Everywhere in the East, excepting in China, learning is disappearing ; manuscripts are no longer copied, and the libraries are dispersed by the accidents of war, and by the poverty of families. In looking over Musulman manuscripts, every one must have observed the seals of some member of a family effaced, which has become too poor as to retain the books, inherited from its ancestors, and is too proud as to let it become known, that it was obliged to sell them. The introduction of the press also contributes to the destruction of manuscripts by decreasing their prices and lowering the respect paid to them at former periods. It is, however, still time to save many of these treasures, and the publication of the catalogues of the European libraries, by directing the purchasers, must greatly contribute to the accomplishment of this purpose.

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[2] Bibliothecæ Bodlianæ Codicum Manuscriptorum Catalogin, confecit Nicoll edidit Purey, in fol. Oxford, 1835.

[3] Catalogus Librorum Manuscriptorum Bibliothecæ Senatoriæ Lipsionsis, ed. Neumann. Codices Orientalium Linguarum Descripserunt; Fleischer et Delitih, 1838, in 4to.

[4] Catalogue de la Bibliotheque d'Edchmiadzin, publié par M. Brooset. Saint Petersbourg, 1810, 121 pages.

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[5] Verzeichnsis der Chinesischen und Mandschu, Tungusischen Bücher der Bibliotkek in Berlin, von Ed. Schott, 1840, in 8vo.

[6] In the Wiener Jahrbuchern, and separately printed in a small number of copies.

[7] Verzeichniss der Orientalischen Handschriften der Bibliotkek zu Tubingen, von Evald, 1839, in 4to.

[8] Catalogue of the Manuscripts of the late Sir R. Chambers, with a Memoir by Lady Chambers. London, 1838, in fol.

We will now state the progress which has been made in the literature of the different nations of the East. We observe, that the Arabian literature has been most actively cultivated. The Committee of the Oriental Translations of London has published the first volume of the History of the Arabs in Spain by Makkari, translated and accompanied with notes by M. Pascual de Gayangos, an erudite Spaniard.[9] Ahmed-al-Makkari-al-Telamsani is a Mogrebin author. Born about the end of the 16th century, he died at Damascus in the year 1631. After having composeda very detailed biography of the celebrated and learned vizier of Granada, Mohammed-Ibn-al-Khatib, he added to it in the form of an introduction, a General History of the Arabs in Spain, from the conquest to their final expulsion. The importance of this work has not escaped those authors who have occupied themselves with this part of the history of the Arabs, and Cardonne, Conde, as well as Shakespear, Reinaud, Lembke, and Fauriel, have made an extensive use of it in their works. It was of course designed for the study of Spanish orientalists; the more so, as Makkari is among the small number of authors who embrace the whole duration of the dominion of the Arabs in Spain. The first volume of M. de Gayangos' translation, which is a very considerable work, is now in your hands, and must be received with gratitude by all the persons who devote themselves to the history of the Arabs. The notes, which by the bye are of very unequal merit, are very numerous with regard to Spain, and contain extracts from a great number of Arabian historians. M. de Gayangos does not exactly give a translation of the original work; he transfers some chapters to introduce a more logical order into the narrative; he omits the life of the Vizier, of which he, however, retains extracts for illustrations; he excludes the fifth chapter, containing the lives of the Spanish Musulmans who travelled to the East, and also the 7th, which gives extracts of the poetry of the Arabs in Spain. It is difficult to judge according to a general principle about this system of translating Oriental works; it is certain, they often contain passages of little interest for the European reader, and relate the facts not in a very natural order; moreover, there is a rage among the Arabian writers, especially at the decline of their literature to quote verses, which is often very annoying for the translator, and of little benefit for the reader, and we may easily understand a doubt of the propriety of translating the whole, yet mature reflection will convince us, I think, that the system of complete translations involves into less difficulties, than that of incomplete ones. By this last method indeed, a work is produced much more agreeably to the general reader; those, however, who would use it for particular researches, cannot consult it but with mistrust, not knowing, whether the translator have not omitted the very facts which they are mostly anxious to obtain. Are there no readers who may regret that M. de Gayangos has rejected the first chapter? For the Spanish Musulmans who travelled in the East, undoubtedly were the most eminent men among their nation, so that their lives must naturally excite our curiosity.

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[9] History of the Mohammedan Dynasties in Spain, from the text of Al-Makkari, translated by Pasc. de Gayangos. London, 1810, in 4to. vol. i.

The first book of the Kitab el Aghani, has been edited by Mr. Rosegarten,[10] and the second is nearly completed. He has accompanied it with the first part of a very curious dissertation upon the music of the Arabs, in which he endeavours to prove, that they borrowed their music from the Greeks. Whether his assertion be founded or not, will be ascertained by the end of the dissertation, which is to appear with the next book of the text, when the reasons adduced for its validity, will enable the reader to form his own judgment. Great care is bestowed on the text of the Aghani, and there is perhaps no other Arabian work which so much demands it as this collection of the lives of the poets, as it is one of the most curious documents of the political and literary history of the Arabs; for it is generally known, how much poetry had penetrated their whole life, and how almost all the information we have of their social and moral condition before Islamism, is derived from their poems and the commentaries on them. Mr. Lane has completed his translation of One Thousand and One Nights,[11] illustrating it to the end with notes, derived from so intimate an acquaintance with modern Egypt, as perhaps no European has ever possessed. The importance of these fascinating tales in oriental literature is incalculable; for they are even at our days the only work of Asia which has become perfectly popular, and these very tales have surrounded it in the eyes of the public with that poetic glory, which inspires so many with the curiosity of studying more deeply the literary treasures of Asia. It is especially this consideration, that every thing contributing to increase the attractions of this book, becomes important for oriental studies, and we must feel indebted to Mr. Lane for his having so well attained this object.

[10] Alii Isfahanensis liber Cantilenarum Magnus. Ed. Rosegarten. Gripeswaldiæ, 1840 in 4to.

[11] The Thousand and One Nights, a new translation from the Arabic, with copious notes, by E. W. Lane. London, 1839-41, 3 vols. in 8vo.

Mr. Veth has published at Leyden the first half of the text of Lobbal Lobab by Soyouti.[12] It is a Dictionary of patronymic names, and of others under which the Arabic authors are much more frequently quoted than under their proper names. The confusion under which the Arabs labour themselves to identify men known under different names, has induced them to prepare dictionaries for obviating this difficulty. Samani in the sixth century of the Hegira has published one, in which he does not only explain the sense and origin of these names, but also mentions with regard to every word the true names of the authors who have had them. This work was abbreviated in the succeeding century by Ibnal-Athir, and this extract again shortened by Soyouti. The work of Samani is at present unknown, if not lost, and the extract of Ibnal-Athir is only known by the specimen given by Mr. Wustenfeld, according to an incomplete manuscript of Gotha. Under these circumstances, Mr. Veth has resolved on publishing the text of Soyouti, who has preserved the definitions of the names, omitting, however, the enumeration of the authors who have borne them, and also the literary details his predecessors had added. The work of Soyouti, is therefore, far from containing all we would wish, but the excellent edition by Mr. Veth is nevertheless an acceptable present, not only because the Lobbal-Lobab explains the often bizarr surnames of the authors, but especially because it contains a great number of names of places, which we in vain are searching in the most complete geographical treatises. It is here perhaps not out of place to call the attention of Oriental travellers to the importance of the treatise of Samani, entitled "Fi'l-Ansab," the discovery of which would much contribute to the progress of Arabic bibliography.

This brings me back to two editions of Ibn Khalli-kan, which at this moment are printing at Göttingen and Paris. Mr. Wustenfeld has published the 7th book of his, while Mr. Slane has finished the excellent text he is editing.[13] A pamphlet has been lately published by Mr. Cureton, on an autograph manuscript of Ibn Khalli-kan, discovered by him, and he would have fain entrusted it to Mr. Slane, as it seems to contain the second redaction of that work.

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[12] This work has appeared in the form of an academical thesis under the title "Specimen Litterio Orientalibus exhibens majorem partem libri. As. Soyouti de nominibus relativis inscripti ——— proponit Johan. Veth. Lugduni Batavorum, 1480 in 4to.

[13] Kitab Wefayat Al-aiyan; Vies des Hommes illustres de l'Islamisme en Arabe, par Ibn-Khalli-kan, publiées par M. le Baron MacGurkin de Slane. Paris, Fermin Didot, 1838-40, in 4to. cahiers i. iv.

Mr. Freitag at Bonn, advertises the third volume of his Proverbs of the Arabs; the two first ones contain the classic work of Meidani, which the third volume will complete, with additional proverbs, not mentioned by this author, and which Mr. Freitag has for the greater part taken from an unedited work of Scherefeddin, and from the proverbs of the Bedooins by Mr. Burckhard. The work will be closed by very copious tables of contents, to enable the reader to find the proverbs which the Arabian authors often indicate by a single word.

Mr. Sprenger, under auspices of the Committee of Translations, has edited the first volume of his English translation of the celebrated work of Masoudi, " The Meadows of Gold."[14] Masoudi wrote in times most favourable for a historian; the Khalifat in the beginning of the 4th century of the Hegira had obtained almost its largest extension, the intellect of the Arabs was not yet put down by the grammar, the rhetoric, and the controversies of the sects, their genius was still stimulated by the remains of the ancient civilisation, and by the literature of the conquered nations, and the position of the Khalifat facilitated the most distant travels. Masoudi availed himself of all these advantages; his reading was immense, his travels uninterrupted, and very extensive. According to the custom of the learned men of his time, he has written on almost all subjects which then could interest Musulman readers; but for us his historical works alone are of interest. The first of his compositions is Akhbar-al-Zeman, an enormous work of at least twenty volumes; the second is the Kitab-al-Aouseth, being the complement to the Akhbar; and the third, the " Meadows of Gold," forming at the same time the extract and the supplement of the two others. This last work alone is known in Europe. Written with a singular want of order and method, it contains the most curious information on a great number of subjects. Not being a mere compiler, as are most of Oriental historians, Masoudi made a great many personal observations and researches on subjects neglected by his predecessors. Mr. Sprenger has compared for his translation the manuscripts of Leyden, Paris, and London, and always added the Arabian orthography of the names, which is of great assistance

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14. El Masudi's Historical Encyclopedia, entitled Meadows of Gold and Mines of Gems, translated by Aloys Sprenger, vol. i. London, in 8vo.

in the use of a work, abounding with names of men and places ; and he also joins to it a certain number of critical and explanatory notes. This work will require much more extensive commentaries, if the variety of subjects to which allusion is made by Masoudi, shall be elucidated ; but the first thing is a complete translation, and it is highly desirable, that Mr. Sprenger should continue his useful and excellent undertaking.

Since the conquest of Algiers by the French, the history of Northern Africa has become a subject of great interest, and we are presented in the past year with many works relating to it, and others we are promised, so that this portion of the history of the Arabs, about which we only possess the very imperfect labours of Cardonne, will soon be numbered with those best known to us. Mr. de Slane has published in the Asiatic Journal, the history of the first Masulman dynasties in Africa, and has advanced it to the Aglabites, where Mr. Noël Desvergers takes it up in a work entitled " Histoire de l'Afrique sous la dynastie des Aglabites, et de la Sicile, sous la domination Musulmane."[15] He gives the text and translation of the narrative of Ibn Khaldoun, accompanying it with notes, principally taken from Nowaïri and Ibnal-Athir. The Aglabites, after having governed the eastern part of the coast of Barbary during the whole third century, were dispossessed of it by the dynasty of the Fatimites, which in their turn for nearly three centuries possessed the greatest part of Moghreb. Mr. Nicholson[16] has edited at Tübingen, an English translation of the history of the establishment of this dynasty, taken from a manuscript of the library at Gotha, erroneously attributed to Masoudi. The work of the unknown writer seems to have served as basis to the narratives, as well of Nowaïri as of Ibn-Khaldoun, and he enters into more details than these two authors have done on this great event of the history of the Khalifat, an event which threatened the existence of the Arabian empire, and to which Europe perhaps owes its escaping from a Musulman conquest.

The French government, well aware of the importance of the history of North-Africa, has for some years made efforts to procure all the means for elucidating it. With much propriety it has attached a great value to that portion of the great work of Ibn-Khaldoun, which under

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15. Paris, chez Didot. 1840, in 8vo.

16. An account of the establishment of the Fatimite Dynasty in Africa, by J. Nicholson. Tübingen and Bristol, 1840, in 8vo.

the title of the "History of the Berbers," treats all that during the middle ages refers to the Moghreb. It has charged Mr. de Slane with the publication of this important work, which will be printed at Algiers, and form two large volumes, containing the text of Ibn-Khaldoun, a French translation, and a historical commentary. The editor has succeeded in collecting a sufficient number of manuscripts, and the unwearied kindness of Mr. Weijers, has placed at his disposal the manuscripts of the library of Leyden. The printing of this work has commenced, and from all circumstances we may hope, that this excellent undertaking will be brought to a close as speedily as possible.

Mr. Cureton, conservator of the manuscripts of the British Museum, has commenced printing the History of Religions by Scharistani, written in the first years of the sixth Hegira. The labours of Pococke and Hyde had a long time since spread the fame of this work, which successively treats respecting the orthodox and heretic sects of the Musulmans, the philosophic schools, the Persian and Sabean sects, the superstition of the antient Arabs, and especially contains on these last subjects a mass of facts, which elsewhere in vain are to be looked for. It is one of those Arabic works, which in our time, when the history of religions has become the object of so much research, will excite the most vivid interest of the public, and we cannot help congratulating the Society for the printing of Oriental texts, to have selected this as their first publication. As Mr. Cureton has no intention of giving a translation, it is a fortunate circumstance, that Mr. Schmœlder at Bonn has been since some years occupied in preparing a translation and edition of the same work, and it is possible, that the undertaking of Mr. Cureton, from which he may derive so many facilities for his translation, may induce him to relinquish the publication of the text. Mr. Schmœlder is eminently qualified for a labour of this kind by his studies of the philosophy of the Arabs, the first result of which he has given in his "Dommenta Philosophiæ Arabum, Bonn, 1836," promising at the same time a new work of the same kind, which is to contain some memoirs on the philosophy of the Arabs, preceded by a treatise of Ghazali. This labour has met with the approbation of the Academy of Inscriptions, which has been recommended to the Minister of Public Instruction, to add it to the number of works encouraged by the French government.

Mr. Dernburg is preparing an edition of the Tarifat of Djordjani, together with a French translation and a commentary. The Tarifat is a dictionary of the technical terms of Arabic Grammar, Philosophy, and Theology, and you all know, what value Mr. de Sacy attached to this work. Mr. Dernburg takes as basis of the redaction of the text, the edition of Constantinople compared with the manuscripts of Paris. I should besides mention a work of Ibnal-Beither on the medicine of the Arabs, which Mr. Sortheimer is translating into German.

The Semitic dialects have furnished this year a subject of new and curious studies. Every body knows, that on ascending Mount Sinai from the Gulf of Suez, one may follow some collateral valleys, intersecting the foot of the mountain, which exhibit on the walls of the rocks they traverse, inscriptions not yet decyphered. One of these valleys abounds so much with them, that it has received the name of "Wadi Mokatteb," the valley of inscriptions. A great number of them have been published in different works, and Mr. Beer at Leipzig, who has already distinguished himself in other branches of oriental paleography, has undertaken the task of decyphering them. He has printed the first part of his labours, forming the third part of his "Studia Asiatica,"[17] and the conclusions at which he has arrived are, that these inscriptions date from the fourth century, that they are written in one of the Semitic alphabets and dialects, and that they are the work of the Nabatenés.

With regard to Persian literature, only one work referring to it has become known to me; viz. Sadi's Galistan, translated into the German, by Mr. Wolff, in a most elegant manner.[18] Other works are commenced or advertized. Your associate, Mr. Troyer, has under the press an English translation of the Dabistan, a work which has a long time excited the curiosity of the learned. It is a history of religions, written in Akbar's time, by a Guebre, Mobed Shah, who turned Musulman. The intention of the author appears to have been to furnish to Akbar, a pretended historical basis of the religion which this emperor had invented, and which he was desirous to introduce. For this reason, the author commences with a very long chapter on the religion of the Mahabadians, which is a mere web of incoherent fables. He then thoroughly enters into his subject, treating on the religions of the Persians, Indians, Jews, Christians and Musulmans, on the Illuminati, the Sofis, and some other sects. This work cannot be used without a certain mistrust; it contains, however, on those obscure sects an infinite mass of details, which will serve to complete the history of religions. Sir W. Jones, I think, first mentioned this work. Gladwin published in the "New Asiatic Miscellany," its first chapter, together with an English translation. Leyden in the 9th volume of the Asiatic Researches, translated the chapter on the Illuminati, and the text of the whole work was published at Calcutta in 1809. The Committee of Translations charged Mr. Shea with the translation of it; but as he died without having made a considerable progress in the work, Mr. Troyer has engaged to complete and to publish it.

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[17] Studia Asiatica, edid. Beer fasc. iii. Lipzig, 1840, in 4to. The first two numbers of this work have not appeared, and the author unfortunately died since the publication of it.

[18] Sadi's Rosengarten, ubersetzt durch Dr. Ph. Wolff. Stuttgart, 1841, in 12mo.

The English Society for the publication of Oriental Texts, advertises three Persian works, of which it prepares editions; viz. Khamschi Nizami, that is, the collection of five poems, half epic, half romantic, by Nizami, of which as yet only one, the Secander Nameh, is printed ; the second is the Youssef and Zuleikha by Furdusi, which Mr. Morley has undertaken to publish. It is Furdusi's last work, written during his flight. It was considered as lost, but was found again a few years since by Mr. Macan. The third, a part of the great work of Raschid-eddin, is the History of India. You know, that Raschid-eddin deposited copies of his work in a certain number of libraries, and Mr. Morley was fortunate enough to discover one of these authentic copies. He intends to publish that part of it which treats on the History of India, as it is one of those which are not met with in the manuscripts of Raschid-eddin in the libraries of the continent.

We have here the best oppportunity of mentioning a remarkable work, which is indebted for the new and important facts it contains to the Persian historians, consulted by the author; we allude to the History of the Golden Horde by M. Hammer de Purgstall.[19] It is well known, that the Golden Horde has reigned in Russia for more than two centuries, exercising the greatest influence on the formation and fate of the Russian empire ; however, a detailed and special history of this important branch of the Mongol empire was required, and the work referred to, in which M. de Hammer displays his vast learning, has fully supplied this want. He does not only follow the History of the Golden Horde, from its origin to the destruction of the empire founded by it, but he also adds new and important facts on the general history of the Mongols, among which the reader will certainly distinguish the description of the organisation of the Mongolian court, forming the fifth book, and the collection of patent letters, addressed to a considerable number of Mongolian civil and military officers. The author, who intends to prosecute this subject, will soon publish a History of the Mongols in Persia, for which a long time he has been collecting materials.

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[19] Geschichte der Goldenen Horde in Kiptschak dar ist der Mongolen in Russland, von Hammer Purgstall. Pesth, 1840, in 8vo.

Before leaving Musulman literature, I cannot omit mentioning the French-Turco Dictionary by Prince Handjeri in Petersburg, which will form three large volumes in 4to., and the first volume of which has appeared.

All persons, most advanced in the Turkish language, are unanimous concerning the great merits of this beautiful work, which is a complete translation of the Dictionary of the French Academy. It is more especially destined for Turks who are studying the French, while the Franco-Turkish Dictionary, which M. Bianchi is publishing in Paris, and of which the printing is nearly completed, appears especially to be destined for European students in Turkish.

In speaking of India, we have received the fourth volume of the Mahabharat, containing the end of the text of the Mahabharat itself, and the continuation of this grand epic, known under the title of Harivansa. We venture to hope, that the Asiatic Society has not relinquished the purpose of completing this work by an onomastic index, to facilitate the use of this immense magazine of Indian traditions.*

The Vedas, now very imperfectly known by the Memoir of Colebrooke, and the first volume of the Rigveda by Rosen, are at this time everywhere the object of the labours of Indian scholars. The Committee of Translations have accepted the offer of Mr. Stevenson of Bombay, to publish a translation of the Sama Veda, which in the ceremonies of the Brahmans, seems to occupy a similar place as the Mass in those of the Catholics. Mr. Wilson prepares for the same Society the texts of the prayers and hymns of the Yadyur-Veda. These hymns composent the real body of the Vedas; they are, to say so, of a primitive formation, and give the first seeds by which the Indian race since that time has exercised such a great influence upon the progress of the human mind. Much later were added to the Vedas a certain number of Upanishads, which are in fact like so many appendices, some of them being commentaries of the hymns, while others contain a systematic explanation of the doctrines of the Vedas, the first result of the tendency of the human mind to reduce religious tradition to a system. You are aware, that Mr. Poley some years ago commenced a lithographed edition of the Upanishads, which he was unable to complete on account of his departure to London; but he is determined to resume his labours, and now advertises an edition of Vishadaranyaka, one of the Upanishads of the Yadyur-Veda. The print of this work is also commenced at the expence of the Oriental Text Society.

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* Such an index has been prepared. The Mahabharat is published by the Asiatic Society of Bengal, with the assistance of the printing fund allowed by the Government of India.

The Indian drama, to which so much attention has been attracted by the labours of Jones and Chezy, and especially of Wilson, has occasioned some publications. Prema-chunder, Professor of the Sanscrit College at Calcutta, has published a new edition of the Sakontala, which contains no other additions to the text than a Sanscrit translation of the passages written in Pracrit, and appears to be destined for the natives of Bengal. To judge by the adoption of Bengalee characters, Mr. Bœthlingk at Bonn, promises a new edition of the same drama according to the manuscripts of London, which considerably differ, and this in important passages from the text of Chezy. This translation is to be accompanied with a Latin translation and notes. Another drama ascribed, but probably erroneously as so many other poems, to Kalidasa, the author of the Sakontola, has been published at Bonn by M. Tullberg; viz. the Malavica and Agnimitra.[20] Text and variation only as yet appeared, but M. Kullberg promises likewise a Latin translation and notes. A third work, attributed to Kalidasa, the Meghaduta, of which Mr. Wilson had already published an edition, and a very elegant English translation, has been reprinted at Bonn by M. Gildemeister, who has added to the same volume a little erotic poem of the title "Sringari-Tilaka." Both texts are accompanied with a complete dictionary. Raja Kalikrisna at Calcutta, advertises an edition an English translation of Maha Nataka, that is to say, the great poem. It is a half dramatic narrative of the Ramayana, which is at present known in Europe by the short analysis only of Mr. Wilson. This work, of which the ape Honuman is believed the author, enjoys great popularity in India. Mr. Hœpfer has published at Leipzig a small volume, containing the first series of translations of Indian poems, the metre of which he imitates in German.

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[20] Malavica et Agnimitra, edidit Fr. O. Tullberg, Fascicular prior textum Sanscritumtenens. Bonn, 1840, in 4to.

The Indian Grammar has been the object of some labours, of which the most important is the second volume of the edition of Panini, edited by Mr. Boethlingk,[21] and the tables, arranged by the editor, much facilitate the use of it. Mr. Hœpfer has published a dissertation on the infinitive in Sanscrit,[22] considered under the view of the comparative Grammar and of the Synthesis. Mr. Westergaard has edited the second part of his Sanscrit roots.[23] The progress of Indian literature since the print of Rosen's Radices, enabled Mr. Westergaard to extend the plan, and to fill out the sketch given by Rosen. Mr. Johnson lastly, has published in London the first volume of the Hitopadesa, together with a grammatical index of all the words. This book is destined for beginners.

The religious controversies, always disturbing India, which from the intercourse of the natives with Europeans had recommenced with renewed ardour, especially at Bombay, have caused some curious publications; I shall offer, however, a remark on only two of them. The first is an antient Sanscrit treatise under the title of " Wajrah Soutchi,[24] by a Buddhist of the name Aswa Goscha, who therein attacks the Brahminical institution of caste. Mr. Wilkinson, political agent at Bhopal, who discovered it, intended to print it as a work, attacking caste, but the Pundit Soobaji Bapoo, whom he employed for this purpose, requested his permission to add to it a refutation under the name "Tanka," also written in Sanscrit, and thus appeared this small volume in Bombay. The second theological publication is the Ta'limi Zerdusht, a (Mobed) Parsee Dasabhaï. This work, composed in the language of Guzerat, and printed in Bombay, contains a defence of Zoroaster's doctrines against the American Missionaries, together with a refutation of Christianity, in which he adopts the arguments of Voltaire against the doctrines of the Catholic Church.

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[21] Panini, 8 Bücher Grammatischer Regeln, horausgegeben von Dr. Boethlingk, 2 vols. in 8vo. Bonn, 1810.

[22] Vom Infinitiv, besonders im Sanscrit, von Dr. A. Hoepfer. Berlin, 1840, in 8vo.

[23] Radices Linguæ Sanscritae definivit, Nic. L Westergaard. Bonn, 1840, in 8vo.

[24] The Wujra Soochi, or Refutation of the arguments upon which the Brahmanical institution of Caste is founded by the learned Boodhist Arhwa Gorhu. ch.

When the progress of a science is very rapid, a scholar would not like to publish a general work to represent the actual state of this science at his own time. This repugnance is very natural, as we know that such a labour will be soon superseded, although works of this kind are eminently useful, not only for the general reader, but also for the learned to whom they represent the history of the former periods, and indicate the wants which they are called for to supply. This service has Mr. Benfey in Berlin, afforded to Indian studies, by selecting and combining the most positive information which we possess about the antient geography, history, and literature of India.[25] In this conscientious work, we observe interesting researches on the study of the antient navigation of the Hindus, on the importance of the study of Buddhism for the History of India, and we are sure, that every one, consulting this work, will derive great benefit from it.

Chinese literature has not given occasion to a great number of works. Mr. Pauthier has under the title of "The Sacred Books of the East," edited a large volume, containing a collection of works, on which the religion and legislation of some great nations of the East are founded.[26] In this volume are embodied the Chou-king, (according to) in the translation of Gaubil, revised by the editor according to the manuscript of Gaubil himself, the four Moral Books of Confucius' school, translated by Pauthier, the Laws of Menu according to the translation of Loiséleur, and lastly, the Korān, translated by your associate, Mr. Kasimirski de Biberstein. This work is destined to render some of the most fundamental works of the East more accessible to the public, while at the same time it affords the evidence of the interest the public have in such undertakings; for the translation of the Korān by Mr. Kasimirski which it contains, is already the second edition within a year, and the printing of a third one is commenced. Mr. Pauthier has also occupied himself with a new edition of the Moral Books of the Chinese, contained in the volume of which I am speaking, and moreover published the Statistical Documents on the empire of China, translated from the Chinese, (Paris, 1841, in 8vo.) They are taken from the official statistic, entitled "Tai-tsing-hoeitien," which give a detailed account of the state of population, and the revenue of each province.

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[25] Indien, von Th. Benfey. Leipzig, 1841, in 4to. partly taken from the Cyclopædia of Ersch and Gruber.

[26] Des Livres Sacrés de l'Orient, traduits on revus et publiés, par M. Pauthier Paris, 1840, in 8vo.

Mr. Bazin advertises the speedy publication of a work, which will highly excite the curiosity of the public; viz. the complete translation of the Pi-pa-ki, a drama of twenty-four pictures, written by Kao-tong-kia, in the fourteenth century under the dynasty of the Youens.

Tsaï-yong is a historic person, who at the commencement of the third century of our era, was president of the tribunal of the historians. He is one of those *savans*, often presented to us in the history of China, who became martyrs to their patriotism; for not being allowed by the emperor to finish the history of the dynasty of the Hans, he died in prison of mental anxiety, arising from the frustration of his purpose. The Pi-pa-ka, however, not treating this catastrophe, introduces Tsaï-yong in his youth. The Chinese critics cannot find adequate language to praise the elegance and the varied merits of this drama, which in their eyes has no other rival than the Si-siang-ki, and they raise it even above this, as in the Pi-pa-ki they find with equal poetic beauties a more pure morality. Whatever value may be attached in Europe to the Pi-pa-ki, it must always be highly estimated, considered as a picture of the customs of the Chinese in the fourteenth century.

Round the four great literatures, the Arabian, Persian, Indian and Chinese, must be placed the literature of other Oriental nations, which have not become themselves centres of civilization, but borrowed their ideas from one or the other of those great nations. In them we must therefore not expect works, stamped with originality, which have made an epoch in the history of mankind. Nor may we hope, that a great number of learned men will cultivate them; but it is desirable that they may not be altogether neglected, and that the wants of government, of commercial transactions, the enthusiasm of the Missionary, or the zeal of the learned, will gradually put them into fuller light, and give the historian access to the facts which may be derived from them, since almost each of those nations, according to the international influence it has enjoyed, is possessed of more or less important chronicles; most of them have also a popular poetry, and their work in theology and in general literature give at least evidence, how far the influence of those nations extended, from which they have borrowed their leading ideas and forms of art. The grammars and dictionaries of their languages by furnishing historic facts, not recorded in the chronicles, are indispensable for ethnography; lastly, each of them has an importance of its own, and fills a corner in the general picture of the East.

Some of those languages during the last year have given occasion to publications. The study of the Georgian language, which the Asiatic Society has first encouraged, has now taken root in Russia, its genuine soil, where it can flourish under the influence of the wants of government. Mr. Brosset, under the title of "Matériaux pour servir a l'Histoire de Géorgie,"[27] has edited a new redaction of the translation of the Georgian chronicle, the first edition of which was published some years ago at the expence of the Society.

Mr. Tchoubinof, employed in foreign affairs in St. Petersburg, and a Georgian by birth, has edited a Georgio-Russio-French Dictionary,[28] infinitely richer than vocabularies we previously possessed. The basis of it is that of Soulkhan Saba, which in Georgia was considered as the best, and together with the additions of Mr. Tchoubinof, contains about 35,000 words.

Mr. Dorn in Petersburg, has published an Afghan Grammar;[29] more exact than Klaproth's, and more detailed than that of Ewald. The literature of the Afghans being scanty, and to our present knowledge mostly consisting of imitations of Persian poetry, the scientific interest in the Afghan language is essentially ethnographic, for the problem of the origin of this people is not yet resolved, and the elements of its solution are to be found in the grammar and dictionary of their language.

The Malayan dialects, almost entirely neglected on the continent of Europe, have lately attracted some attention, and Mr. Dulaurier has opened a course of lectures on the Malayan language in the school of the living languages. Not to mention that this language has its own literature, it is of great importance for ethnography, as the restless and trading race of the Malays is spread over an immense range of coasts and islands, and the history of this idiom for the greatest part is also that of the maritime population of the Eastern and Southern seas. A great scholar, the late Mr. W. De Humboldt, had seized on the solution of the problem which the origin of these people offers, and most thoroughly investigated it in his masterly work on the Kawi language;[30] the last two volumes of which have appeared last year under the auspices of the Academy of Berlin by the care of Mr. Buschmann. He founds his researches on the Kawi, the antient language of Java, reconstructing its grammar by analysing the text of Brata Yuddha. Then proceeding to a similar analysis of the other Malayan dialects from the Philippines to Madagascar, he supplies the insufficiency of his resources by the strictness of his method, and by the astounding penetration of his mind. The grammatical investigation is enriched in all parts of the work by memoirs concerning the influence of India on the Malays, on the antiquities of Java, on the influence of writing on language, etc. memoirs which render this work a mine of new and important ideas, and where the penetration and the mental power of the author are equally displayed.

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[27] Taken from the Memoirs of the Academy of St. Petersburg, 1840, in 4to.

[28] St. Petersburg, 1840. in 4to.

[29] Taken from the Memoirs of St. Petersburg, 1840, in 4to.

Mr. Buschmann advertises, that he intends to publish the text and translation of Brata Yuddha, which will form the complement to Mr. De H.'s work. It is an epic poem, an imitation of the Mahabharat, of which Raffles had already given a part in Latin characters. Written in Kawi, it dates as the Indian Poem to a period when the influence of Indian ideas in Java had not yet submitted to the Musulmans.

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After having presented to you this sketch, unavoidably incomplete, of the progress that Oriental literature has made since our last meeting, I would desire to add a few words concerning a subject which has occupied, and is now occupying a great many learned men, and which deserves the whole attention of a Society, destined for the interests of Oriental literature. I allude to the variety of systems, at present adopted, to express the Oriental by Roman characters. At the first intercourse of Europe with the East in the middle ages, oriental words were rendered in a most barbarous manner, and thence arose the origin of a certain number of monstrous names, some of which have been retained in all languages of Europe, as Mahomet, Mosk, Tamerlan, Gengiskan. Since the last half of the seventeenth century, the Latin translations of some Arabian works by Pococke, Golius, and others, and a little afterwards the popular works of Herbelot and Galland introduced a more exact orthography, by rendering the Arabian words as faithfully as the comparative deficiency of this alphabet permitted. A long time people were satisfied with this method of writing, but at last, and especially since the discovery of the Sanscrit had enlarged the circle of oriental studies, the want of a stricter method became apparent. A degree of exactness was aimed at to render again in the original characters, what had been previously expressed by the Roman alphabet; the systems, however, previously adopted, were unfit for this purpose, and whosoever attempted to reconstrue in Arabian characters verses, quoted by Herbelot, must have been convinced of this.

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[30] Uber die Kawisprache auf der Insel Java, von W. Humboldt. Berlin, 1826, 39, 3. vols in 4to.

Since that period, systems rapidly succeeded each other. Founded on the most different principles which were calculated to avoid difficulties of several kinds, they have produced the most opposite results. Sir W. Jones so early as the year 1788, complained of almost every author having a system of orthography of his own. What would he have said of the number of systems, and the still greater number of orthographies without any system in the present day. Historians, geographers, travellers who never study the languages of nations, take at random the different orthographies and confound them, so that it is impossible to trace them to their sources, and hence ensues a mass of confusion. Of this I shall give some examples by taking the easiest familiar names I at present recollect. For instance, the name of Ali in works of our time is found thus: " Ali, Aly, Ali, Alee, Ulee, Ullee, Alli, Aliyy, Ahli, Alee." I find nine ways of expressing the word Koran: " Kuran, Ckooran, Alcoran, Alcorawn, Qoran, Coran, Koran, Ckoran;" six to write the name of Aboulfeda: " Aboulfada, Aboulfeda, Abulfeda, Abowlfida, Abowlfeda, and Aboulfidâi," and seven for the name of the legislator of the Arabs: " Mahomet, Mehemet, Muhammed, Mohammed, Muhammad, Mohhammad, and Muhummud."

In names so well known as those just quoted, there can hardly arise errors from these discrepancies in orthography; but in names of obscure men and places, the confusion arising from it, may be easily imagined. I shall give an example. Mr. J. Prinsep quotes an official and modern map of the Duab, where the road from Akbarpore to Cawnpore, a road very much frequented, is doubly entered, because the topographic bureau of Calcutta had found two routes with names, written in such different ways, that their identity not being recognised, they were believed to refer to parallel routes.[31]

It would perhaps have been better never to have deviated from the old system, however imperfect it was, as the thing of real importance is uniformity. But now it is too late to retrace our steps; the want of exactness having once been perceived, we must endeavour to supply it, hoping the introduction of a system, infinitely superior to the others, will re-establish that unity from which we are so far at present.

‹It is, meanwhile, I hope, not without use to classify the difficulties which such a system offers, and the attempts which have been made to remove them. These difficulties, it appears to me, are the following :—

1. Oriental alphabets have a much greater number of letters than ours.

2. Orientals do not always pronounce according to the rules of orthography.

3. They disagree in the pronunciation of the same letter in every country.

4. Europeans disagree in the pronunciation of the same letters.

1. Oriental alphabets have a much greater number of letters than ours. This especially has application to the Arabian and Indian alphabets. The means to obviate these difficulties, may be reduced to three classes.

a. The attempt has been made to enrich the Latin alphabet with some new characters. Thus has Meninski introduced the Arabian Ain; Volney modified the form of some Roman characters; Mr. Gilchrist invented a short u, and other learned men at a still later period used some Persian and Greek characters in their systems of rendering.

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[31] See the Map in "The application of the Roman Alphabet to all the Oriental Languages." Serampore, 1834, in 8vo.

None of these systems, however, were universally adopted, and the European public is not willing to tolerate the introduction of new characters into its alphabet.

B. It has been proposed to represent Arabic and Indian sounds by groups of European characters, as dh, th, kh, tt, ss, etc. This system has produced a great number of essays, but it has real inconveniencies; for if partially applied only, as the greater part of the learned do, the object which was in view with regard to it, is not attained; and if carried to the extreme, it renders strange the form of Oriental words, affording combinations of characters, which must appear barbarous to a European reader, as "Ckasr or Qasr, Hhadrat, Hadjdjadj," etc. Moreover, the system of expressing by double characters the simple ones which we do not possess, has the great drawback of leaving the reader in the dark concerning the orthography of the original, because he cannot know, whether the double character represent two characters, or be only the conventional representative of a single one.

C. Lastly, others have tried to modify the Latin alphabet by marks, not very apparent, which without producing new characters, exhibit various forms, by which the letters of Oriental alphabets may be easily exposed. This system, I think, was first proposed by Sir W. Jones, and adopted by the Asiatic Society of Calcutta, which, however, did not always adhere to it. According to it, the vowels are multiplied by accents, when they are short or long, and the consonants by points above or below. This system has had many imitators, and almost all Indian scholars have made similar ones for their rendering. Gilchrist has partly preserved it; the Geographical Society of London has adopted it with a few modifications; Mr. Erchhoff in France has made use of it in his parallel of the European languages; and lately, has Mr. Brockhaus proposed a similar one in Germany; Mr. Weijers has published another, resting on the same basis, and Mr. Arni, of Turin, has formed characters, on which he marks the different t, d, s, etc. of the Arabs by the same points, by which they are distinguished in the Arabic language. This method has the inconvenience easily to occasion errors, and to require a much larger printing apparatus, but it atones for these material difficulties by evident advantages. The European is not inconvenienced in his reading, for if he do not know the signification of the points added to the characters, he may easily overlook them, and without their introducing an error, the reading of the words is not crammed with a mass of supplementary d'h and other characters; lastly, it approaches much nearer to that which only attempts to render the simple sound, without pretending to imitate all its shades, so that it is easy to identify words, written by a scholar, with those which a traveller, according to the mere pronunciation, has written down. The great mischief at present is the variety of systems, founded on this method; for we cannot expect, that the public shall become accustomed to this modification of the alphabet, unless the signs be generally adopted.

2. The Orientals do not always pronounce according to the rules of orthography, and this difference between the manner of writing and of pronouncing especially arises from euphonic laws. They, for instance, write al-Raschid, while pronouncing ar-Raschid. Mr. Weijers proposes to distinguish a character, subject to such a change, by putting it in italics; but this expedient displeases the eye, without indicating to the reader the real pronunciation. This problem is evidently indissoluble, and we have the choice between the sound and the orthography. The custom of the European nations with regard to this has established the excellent principle of submitting ourselves to orthography; thus is written in all European languages "Shakespeare, Bordeaux" etc., though the sound to be derived from this combination of letters, be much different from the real pronunciation. To follow the orthography is the only means not to efface the etymology of a word, and to preserve a chance of unity in renderings; yet there always remains a great confusion in the representation of short vowels, so differently pronounced in different words of the same language, that it becomes difficult to express them in all instances by the same vowel of our alphabet.

3. One and the same letter is differently pronounced by every Oriental nation. The Turks, for example, generally substitute for the short A of the Arabs and Persians a short E; the Musulmans of India in many instances pronounce an E long, when the Persians pronounce a long I; in Persia a long A is substituted for a long Ou.* The Ara-

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* My readers will remember to give the sound of these vowels as in French.

bian ج is differently pronounced in different countries. The era of Mahomet, for example, is pronounced Hidjret in Syria, Higret in Egypt, Hijret in Arabia, etc. The confusion, arising from these variations, is often very great; for instance, the name of the present king of Lahore, is pronounced Schîr Singh in India; the first part of this name is, however, of Persian origin, and is pronounced in Persia Schîr. How then to render? The most logical method, even in a similar case, would perhaps be to adopt the pronunciation of the country where the word originated; but there fortunately are not many so complicated cases, and ordinarily, the renderings of a word may be without inconvenience in conformity with the orthography of the country from which it is borrowed.

4. The last difficulty is, that the European nations likewise differ in the pronouncing of one and the same Roman character, and at the first glance, this appears an insurmountable obstacle to a uniform system. Sir W. Jones was well aware of the confusion connected with this question, especially for the English, whose orthographical system is so complicated, irregular, and so deviating from the usages of all the rest of Europe. He had the wisdom to propose the adoption of the Italian pronunciation, and persuaded the Asiatic Society of Calcutta to consent to it, which since that time has continued to follow this system, the only one, by which the English Oriental scholars can be in conformity with those of the continent. Subsequently Mr. Gilchrist unfortunately did all in his power to undo the work of Sir W. Jones, by substituting the complicated English diphthongs for the simple vowels of the Italians. Almost all his pupils have adopted his system, and the Oriental geography and history have too much resented this unfortunate alteration. The oo, ee, u, have taken the place of the u, i, a, in most of the modern books of the Anglo-Indians, and the authority of all the learned Societies of England and India has in vain up to this time opposed this nuisance, though it appears to have lost ground, and we must hope that the principles of Sir W. Jones will again take the lead. There remain some other difficulties; the letters g, j, e and ch, (v, w, s, z,) have in every European language a different pronunciation, so that a congruous alphabet could not be adopted with uniformity in all European languages. These difficulties, however, not being very numerous, would not occasion much confusion, if every nation, as much as its idiotims

allow, try to approach to the others, and not prefer the extremes of its peculiar pronunciation, as the school of Mr. Gilchrist has done.

All these mutual concessions being granted, and all precautions taken, I do not think, that a uniform alphabet will be obtained, by which Oriental characters should be introduced into the text. It is generally known, what importance Volney attached to this idea, and the Committee of Public Instruction in Calcutta for some years thought to have so clearly solved this problem, as to encourage the publication of a great number of works in what is named, the Roman alphabet in India, and that this Committee for some time has suggested the truly monstrous plan of substituting, even for the natives themselves, this alphabet for their original ones. This experiment has not succeeded, and could not succeed; a system of expressing intelligibly an occasional passage of a language, and which may be useful for quotations, or when the original characters are wanting, may be applied to some languages, as for instance, has been done to the Sanscrit; but there are other languages which do not admit this expedient, as for instance, the Arabic language, where the orthography not only expresses the sounds, but often also the grammatical and etymological peculiarities which do not touch the ear, and would be lost by any rendering; thus I doubt, if any combination of Roman characters could represent the orthography of the word Koran. But there is fortunately no necessity for supplanting oriental characters; from this might arise some economical advantage in printing Oriental texts, but it would be infinitely less than the inconveniencies of every kind produced by it. We are rather in want of a system of expression sufficiently exact to reproduce the names of men and localities in a way which may approach to the ordinary application of the Roman alphabet, so that it is not repulsive to the mass of readers and authors, and only requires slight modification in its application to the languages of Europe. The adoption of a system, corresponding to these conditions, would be a benefit to literature, and no public body holds a better position than a Society such as yours to encourage and to direct discussion on all the points connected with it, and to arrive at a result which could obtain the assent, if not of all, which cannot be expected in such a matter, but at least of the majority of authors.

Proceedings of the Asiatic Society.

(Friday Evening, 6th May, 1842.)

The Hon'ble H. T. Prinsep, Esq. President, in the Chair.

G. Cheap, Esq. C. S. was proposed a Member of the Society by the President, seconded by the Secretary.

***Books received for the Meeting on the 6th May,* 1842.**

Journal of the Royal Asiatic Society of Great Britain and Ireland. London, 1841, vol. vi. No. 12, 1 vol.

Proceedings of the Committee of Commerce and Agriculture of the Royal Asiatic Society of Great Britain and Ireland. London, 1841, (5 copies,) pamph.

The Calcutta Literary Gleaner, May, 1842, vol. 1st, No. 3rd, pamph.

The Calcutta Christian Observer, May, 1842, new series, vol. 3rd, No. 29, pamph.

Report on the Settlement of the district of Seharanpore, compiled by E. Thornton, 1840, 1 vol.

Actes de L'Académie Royale des Sciences, Belles Lettres, et Arts de Bordeaux. 1er. à 4e. Trimestres. Bordeaux, 1839, 4 vols.

Read a note from Dr. R. M. Thompson, presenting a Human Skeleton for the Museum of the Asiatic Society.

Ordered,—That the thanks of the Society be accorded to Dr. Thompson, and he be requested at the same time to state from whence the Skeleton is.

On the 22d April last, enquiry was made through Mr. Secretary Bushby, as to the number of copies of Dr. Cantor's Report on Chusan, (under publication as an article in the Asiatic Researches,) would be required by Government.

Read letter of 27th idem from Mr. Deputy Secretary Bayley, intimating that the Government would require 50 copies with the Drawings in illustration. The Secretary at the same time submitted to the inspection of the Meeting the drawings referred to.

Read letter of 4th May 1842, from Reverend J. Thomas, submitting Bill for printing the Index to the several volumes of the Mahabharut, and for binding the same, amounting to Co's. Rs. 2,012 : 7 : 9. Ordered to be paid.

Read the following two letters of the 13th February, and 10th March 1842, from Captain W. Macleod.

Moulmein, 13th Feb. 1842.

My dear Torrens,

The accompanying Image is one of two just sent me from Rangoon, (where it was dug up,) by order of the King's uncle, the Mekhara Prince.

The Prince is an honorary member of the Society, (vide his letter on his election 5th February, 1836, page 433,) and has a philosophic turn. He assisted greatly in the compilation of Mr. Lane's Dictionary of English and Burmese. If circumstances permitted, (for though he is the King's uncle, and a member of this present Government,) he would willingly add to our information about his own country, but unfortunately, he is obliged to be very cautious in his intercourse with us. Indeed the manner in which the Images were sent shews this. Mr. Sarkies, to whom the Prince intrusted the dispatch to me of the Images, first proposed forwarding them through Mr. Browne, but after the departure from Rangoon of the King and Court, and finding a person, an Armenian countryman of his own, to whom he could trust, he sent them to me with a note from himself, and a memorandum from the Prince.

Mr. Sarkies writes,

" While the Prince of Mekhara was here, he gave me two ancient Idols, which he " ordered me to send to you, and which I now accordingly beg to forward by Mr. " Catchatoor. The object of so doing is to inform you, that this kind of Idol has been " also found in various parts of the world at different times. He hopes they will serve " you as a curiosity."

The Prince's Memorandum is to the effect, that " the Images are the same as those " found by Captain Hannay at Tagoung Myo, the inscription the same also in old " Deva Nagari characters, and that they must be at least 1800 years old."

I have just received them, and will make enquiries as to the localities where they were found, as Mr. Browne mentions a number of the same description were taken up. Rangoon is the site of an old city, and we may be able to trace some connexion between its foundation and that of the old city of Tagoung.

You will find an account of the Tagoung Images in the vol. of the *Journal of the Asiatic Society,* for 1836, page 157. I never saw the images therein referred to, but conclude they are with the Society.

Should you think fit to notice the subject in the Journal, perhaps the less prominently the Prince is brought forward the better. We are certainly much indebted to him for sending them.

Yours ever sincerely,
W. Macleod.

P. S. I got a vol. of the English and Burmese Dictionary for him from Bayley, but if you have any at the disposal of the Society to spare, I am certain he would esteem it a favour if you would present him with one. The copy he has, in that case I fancy he would place at the disposal of the King.

My dear Torrens,

Since writing to you with the Image, I found a Plate of the one brought down by Captain Hannay, in the *Journal ;* it differs from the one I sent you. The principal image in Captain H.'s is supported by two figures, whereas the Rangoon one has two Pagodas. The Mekhara Prince in his note mentioned, that those he sent me resembled some Dr. Bayfield brought down from Tagoung, but never having heard of these, I erroneously supposed His Highness had confounded Dr. Bayfield with Captain Hannay; but Dr. Richardson has put me to right. Both Dr. B. and Captain H. visited Tagoung, and both appear to have found images with the Deva Nagari inscription, though Captain Hannay's discovery only has been recorded.

I have not been able to hear any thing further on the subject.

Yours very sincerely,
W. Macleod.

Moulmein, 10*th March,* 1842.

The Image referred to, has been received, and placed in the Museum.

Read letter of 23rd March 1842, to Secretary to the Military Board from Captain G. B. TREMENHEERE, forwarding some concluding Remarks by him on his report on the Tin Grounds of Mergui.

Read letter from Mr. Secretary BUSHBY of 9th March last, forwarding Correspondence containing information on the Nurma Cotton Ground in Guzerat.

Read letter from Lieut. Colonel A. SPIERS, Resident at Gwalior, of 25th March last, and enclosures on the subject of the Nurma Cotton Ground in Gwalior.

Read the following papers by Captain R. SHORTREEDE, First Assistant, Grand Trigonometrical Survey; viz.

On the calculation of Barometric Heights with Tables.

Remarks on some of the disturbing causes in Barometric Observations.

Remarks on an Inscription of a Magic Square, copied from an old temple in the hill fort of Gwalior.

The Secretary intimated that the subjects of the foregoing papers would be noticed by him in early numbers of the Journal.

Read letter of 9th April 1842, from Lieut. Baird Smith of Engineers, forwarding a " Note on the recent Earthquakes on the North-western Frontier." Lieut. Smith writes, " My object being to attract attention to these interesting occurrences, " and to secure some more methodical and carefully detailed information relative to " their various phenomena than we have hitherto had." The " Note" referred to, the Secretary intimated would be published in an early number of the Journal.

Read following Letter of 16th April 1842, from Dr. A. CAMPBELL, of Darjeeling.

Darjeeling, April 16, 1842.

MY DEAR TORRENS,

I had not time to make a memorandum for the Society of the last hours of De Körös, but in my report to Government, forwarded this day, you will find almost all I could have said. You can readily get it from Bushby's office, and make any use of it you think necessary. It concerns you to look after the bequeathment of Rs. 5,000. I hope the Society will not think me an unworthy member for not having furnished you with a report, but to have attempted one formally, and for a learned Society, would have led to the notion that I believed myself capable, from a knowledge of the pursuits of the deceased, to do justice to his merits. Whereas in my official report to Government, this is not looked for, and still it may serve to communicate some interesting particulars to the world and his friends. I hope the Society will erect a monument over him. Here we would subscribe to it. What a pity it is that he did not die near Hodgson!

Yours, &c.

A. CAMPBELL.

The Official Report referred to by Dr. **Campbell**, has been forwarded by Mr. Secretary **Busby**, for the information of the Society, and will appear in an early number of the Journal.

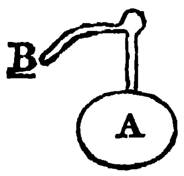
The report having been read, it was proposed by the President, and seconded by Colonel H. **Burney**—That the Society record its deep regret at the death of this most able and eminent philologist and enterprising traveller, the loss of whose services in the exploration of countries so little known as Thibet, and its circumjacent regions, and in the elucidation of historical and philological questions, connected with the races which inhabit those interesting and almost unknown tracts, may be looked upon as a calamity to be deplored by the learned world of Europe, and that the sum of Co's. Rupees One Thousand be placed at the disposal of Dr. A. **Campbell**, for the erection of a Monument, adding thereto a Tombstone, with suitable inscription to the memory of the deceased.

Read a letter of 12th April 1842, from Mr. G. T. **Lushington**, intimating that he had on that day "forwarded another specimen for the Society's Museum, which I hope and believe will prove acceptable. It is the Skin of a Fox brought down by the Jowalier Bhotias this year, from the vicinity of the great Himalayan Chain. The fur is, in my opinion, and indeed in that of all who have seen it, very beautiful, and as it seems to have been well preserved, I hope your Curator will be able to make a good job of it."

"I do not know whether you have any other specimen in the Museum, but think it not likely that you have one, unless **Hodgson** may have sent one from Katmandhoo. The under-hair of the animal is something like that of the Shawl Goat in fineness of texture. Its *habitat* may be said to be the lofty mountains of Jowalier and other Bhote Mehals, in the vicinity of the eternal snows."

"I have another article ready for you, but want to know whether it is worth sending. If you already have it, of course it is not worth the carriage, but if it is new to you, I think it will be prized.

"It is the Steam Blow-pipe used by the Sonars of Almora, and other parts of the hills. It is of copper, about five inches in height, and of this shape. The globe A being first slightly heated, the nozzle B is inserted into a cupful of cold water, which it rapidly sucks up, thus filling itself. It is then placed in a brazier, and the steam formed by the boiling water contained in the globe is expelled at the nozzle



" B with considerable force, and thus produces a continued and powerful
" blast.

" The people here say it came from " Choon"—and believe one of the Nepalese
" Soobahs first introduced it, about forty or fifty years ago. The curious part of it, I
" fancy, is the distinct application of Steam to one art so many years ago, among a
" people so utterly devoid of mechanical knowledge in other matters as our hill
" men are."

The specimen has been received, and placed in the Museum, being previously mounted.

Read letter of 18th April 1842, from Lieutenant J. Brockman, H. M. 50th Regiment, presenting two Tartar Bows, &c. Quiver of Arrows taken at Amoy, also a kind of Sword taken at Chinhae.

The Secretary submitted to the Meeting private Seals and Seals of Office found in the house of the principal Mandarins of Amoy at the taking of that place; a Silken Belt, a Chinese Soldier's Uniform with the name and number of his corps on breast and back, taken at Ningpo from the Chinese Arsenal, and a curious Under-Shirt for wearing next the skin in hot weather, taken at the storming of Chinhae.

The whole presented by Mr. Dalrymple of the C. S. to whom the best thanks of the Society were voted.

The Secretary at the same time presented a Standard Colour of a Chinese Marine Regiment, and a Sword taken at the storming of the Bogue forts in China.

The following list of specimens were presented by Colonel H. Burney :—

An Echinite, from Jebel Jaise, near Cairo.

Specimen of a portion of the stem of a Fossil Palm, and samples of fossil exogenous wood, from the petrified forest near Cairo.

Ditto of Limestone, of which the great Pyramid is built.

Ditto of close Stalagmitic Limestone, whereof the splendid mosque now building by Mehemet Ali is constructed.

Ditto of the coarser of two kinds of Granite met with in the vicinity of the Pyramids, and of which some of the latter are partly constructed, together with various Sarcophagi.

Read petition of 2nd May 1842, from Sree Ram Govinda Sormona, praying to be presented with the last vol. of the Mahabharut for correcting the proof sheets of Sanscrit Books. The presentation ordered.

Read letter of 28th April 1842, from Lieutenant A. Cunningham, intimating that he was "busy with a very long article on the Coins of Kashmere. Fourteen plates are now finished, and the fifteenth is now being lithographed. A supernumerary plate must be added to contain the coins of various new, besides some curious types of known, kings, and the last plate will be one of Monograms, so arranged as to shew at a glance the names of all the kings who used any one Monogram, and all the Monograms which any one king used."

Read letter of 14th April 1842, from Dr. T. A. Wise, assenting to the proposal of printing his Commentaries on the ancient Hindoo System of Medicine.

Read Mr. Lovell Reeves' letter to Mr. Blyth, requesting proposal for the purchase of his book, (Systematic Conchology,) by the Asiatic Society. Ordered, that two copies (with colored plates,) of the work be subscribed for the Library of the Society.

The Curator read his Report for the month of April 1842, as follows :—

Sir,—I have the pleasure on this occasion to congratulate the Society on the variety of presentations made for their Museum during the past month, and on the number of different persons who have thus contributed to its enrichment. These donations have principally consisted of Mammalia, Birds, and Shells, with a valuable box of Insects from Afghanistan, and are as follow :—

Mammalia.

From Dr. Pearson, the Society has received a number of skins, but unfortunately not prepared for being mounted, which are referrible to the following species:

Ursus Tibetanus, the Black Bear of the Himalaya, figured by Mons. F. Cuvier.

Cervus (Styloceros) Muntjac, v. *Ratwa* of Hodgson: the *Kakur*, or Barking Deer of sportsmen.

C. (Rusa) Hippelaphus: the Sambur, adult and young.

Næmorhædus Thur, Hodgson: two skins of males.

Bos (Bison) grunniens: the Yak, a particularly fine skin.

B. (Taurus) Gaurus, v. *Bibos cavifrons*, Hodgson, and *Bos aculeatus*, Wagler: the Gaour; a very large skin, from Arracan. The Gaour, I may remark, ranges southward into the Malay Peninsula, from which locality there is a horn of this species in the Museum of the Hon. Company in London: the dimensions of one killed on the Keddah Coast, with a figure of the head, are given in the Royal Asiatic Society's Journal, III. 50; and there is a skull of a female, understood to be from the South of China, in the London United Service Museum. Dr. Helfer states that, in Tenasserim, "the great *Bos Gaurus* is rather rare, but *Bison Guodus** very common; besides another small kind of Cow, called by the Burmese *F'hain*, of which I saw foot-prints, but never the living animal." *J. A. S.*, VII. 860. Of this latter more presently. In the Indian Peninsula, the Gaour inhabits all the extensive forest tracts from the Himalaya to Cape Comorin, and there can be little or no doubt that the ***Guavera*** of Ceylon, noticed by Knox, refers to the same species. Major Forbes, in his recently published 'Journal of Eleven Years' Residence' in that Island (II 159), informs us that it has been extirpated in Ceylon for more than half a century. A correspondent of the 'Bengal Sporting Magazine,' (for 1835, 217,) writing from the southern Mahratta country, remarks, that "the Bison of this jungle differs materially from those of the Mahabuleshwer hills. The latter is merely a blue Cow of the colour of a Buffalo, but of large size. The regular Bison of Dandelly is a tremendous animal, its highest point being the shoulder." From this it might be inferred, that the North-western animal had not the same elevated spinal ridge; but I am little inclined to suspect that they are different, the more especially as I find the following passage in the 'Transactions of the Agricultural and Horticultural Society of India,' VII. 112. "The only wild cattle we have," observes the writer, J. Little, Esq. "is the *Gowha* of the natives (*Bos Gaurus*). This animal is found in the dense jungles, along the whole range of the Western Ghauts from Assurghur to Cape Comorin. A male was shot at the convalescent station of Mahableshcr, near the source of the Kristna, which measured at the shoulder fully seventeen hands high." I have credible information of a Gaour which stood not less than nineteen hands in vertical height. That the Gaour varies much in size, I can assert from personal observation of about forty skulls of this species*: one of an adult male taken to England, by the late Honorary Curator of this Society, Dr. Evans, is quite a pigmy in comparison with the enormous head in the United Service Museum. A head of a female, with the skin on, in that of the Hon. East India Company, was presented by the late Major-General Hardwicke, as the *As'l* or *Asseel Gayal* of that naturalist, (who figures it in one of the volumes of the 'Zoological Journal,') and of Dr. McCrae ('Asiatic Researches,' VIII. 495). The latter author speaks of it as the *Seloi* of the Cucis, or Kookies, and *P'hanj* of the Mugs and Burmahs; which last name is doubtless identical with the *F'haın* of Dr. Helfer, applied to another species.

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* Evidently a misprint for *Gavæus*, the Gayal: for the words may be written to look very much alike.

In the passage I have already quoted from Dr. Helfer's list of Tenasserim animals, three species of this group are mentioned, the second of which I conclude to be the Gayal (*B. frontalis*, Lambert, Lin. Trans. VII. 57 and 302, v. *B. Gavæus*, Colebrooke, 'Asiatic Researches,' VIII. 487, v. *B. Sylhetanus*, Duvaucel, F. Cuv. *Mammal*), which Baron Cuvier strangely suggests to be a breed between the common Ox and Buffalo ('Régne Animal,' I. 280, and again in his 'Ossemens Fossiles'), but which is a genuine species, of which splendid living examples were, not long ago, in the park at Barrackpore, perfectly tame and gentle. This animal has never been found to the westward of the Boorampooter, and its skull has lately been figured by Mr. Hodgson (Journ. As. Soc. 1841, 470). I am unaware that any trace of it exists in any Museum.

Another very fine species of this group is the Banteng of Java and Borneo (*Bos Sondaicus*, Muller, *B. Bentinger*, Temminck, and *B. leucoprymnus*, Quoy and Gaymard), though, as regards the last, I have the authority of Dr. Schlegel of Amsterdam for asserting, that the individual described by these naturalists was a hybrid between the Banteng and the domestic species, such as are very commonly produced in Java, and especially in the Island of Bali, being trained there for domestic purposes. Sir Stamford Raffles notices, in his 'History of Java' (I. 111), that "the degenerate domestic cows [of that island,] are sometimes driven into the forest to couple with the wild Banteng, for the sake of improving the breed"; and in Moor's 'Notices of the Indian Archipelago,' p. 95, we are informed that, in Bali, "the breed of cattle is extremely fine, almost every one of these beasts being fat, plump, and good looking; you seldom, if ever, see a poor cow in Bali: it is a breed of a much larger size than the common run of cattle in Java, and is obtained from a cross from the Wild Cow, with the same animal; they are generally of a red colour, and all of them are white between the hind legs, and about the rump, so that I do not recollect seeing one that was not white-breeched. The people have no land expressly devoted to grazing, but let their cattle eat the old stubble, or fresh grass of the rice-fields, after the crops have been taken off; and while the grass is growing, they let the cattle stray into the commons, and woods, and pick up what they can get by the road-side. The rude plough is drawn by two oxen abreast, which the ploughman drives with one hand, while he guides the plough with the other." There is a figure of a hybrid half-Banteng Javanese Cow in the collection of drawings bequeathed by the late Major-General Hardwicke to the British Museum, and of which I possess a rough copy.

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* In London alone, there are specimens in the British Museum, that of the Hon. East India Company, of the Zoological Society, Royal Asiatic Society, Royal College of Surgeons, London University, King's College, the United Service Museum, besides many in private collections, as that of Professor Bell, Mr Blofeld of Middle Row Holborn, &c.

The colour of the pure Banteng is similar to that of the Gaour and Gayal, or earthy-brown passing into black, with the four limbs white from the mid-joint downward, in addition to which this species has constantly a large oval white patch on each buttock, whence the name *leucoprymnus* bestowed by M. M. Quoy and Gaymard. Sir Stamford Raffles mentions, that "a remarkable change takes place in the appearance of this animal after castration, the colour in a few months becoming invariably red" *(Hist. Java,* I. 111). Its frontal ridge has little tendency to become elevated; and the following is a description of the finer of two frontlets of the male in the Museum of this Society, presented by Prince William Henry of the Netherlands (vide J. A. S. VI. 987). Horns very rugous at base, flattened as in the Gaour and Gayal, but in a less degree, and somewhat similar in flexure to those of the Gaour, though approaching more in this respect to those of the Cape Buffalo, of a black colour, and twenty inches and a half long over the curve, fourteen and a half round at base, their widest portion thirty-five inches apart measuring outside, and tips returning to twenty-seven inches; at base they are six inches asunder across the vertex, widening anteriorly. According to Dr. Solomon Muller, "the Banteng is found in Java in territories which are seldom visited by man, as well in the forests of the plains and of the coast, as in those of the mountains, where it is pretty common. We have likewise seen traces of it in Borneo, and have even received a calf from the Dujaks about a month old. According to Raffles it is also found in Bali; but in Sumatra it does not appear to exist." Sir Stamford Raffles states, that "it is found chiefly in the forests eastward of Pasúran, and in Bali, though it also occurs in other parts of Java."

To the same distinguished statesman, we are indebted for the following piece of information respecting the domestic cattle of Sumatra:—"There is a very fine breed of cattle peculiar to Sumatra, of which I saw abundance in Menangkabu when I visited the capital of that country in 1818. They are short, compact, well-made animals, without a hump, and almost without exception of a light fawn-colour relieved with white. The eyes are large and fringed with long white lashes. The legs are delicate and well-shaped. Among all that I saw I did not observe any that were not in excellent condition, in which respect they formed a striking contrast to the cattle generally met with in India. They are universally used in agriculture, and are perfectly domesticated. This breed appears to be quite distinct from the Banteng of Java and the more eastern Islands."—*(Lin. Trans.* XIII. 267.*)*

It is, I suspect, no other than a domesticated race of the "Wild Ox" of Burmah; an evident species, of which abundant notices may be found in various works, but no satisfactory description. A skull of such an animal, but unfortunately deprived of the horns, and which is very distinct in form from that of either of the foregoing species, exists in the London United Service Museum, and is labelled "Bison, from the Keddah Coast." I possess some very carefully prepared drawings of this specimen. Captain Gason, of Her Majesty's 62nd Regiment, who has himself been at the death of a Burmese wild bull, has favored me with the following particulars concerning this species:—"These animals stand about fifteen hands and a half high, are very *game*-looking, with a heavy body, but fine limbs. Their colour is bright yellowish-buff with a black line from the vertex to the tail, the legs black in front, the tips of the ears, muzzle, and tail-tip also black, and the belly perfectly white. There is little or no difference of colour between the sexes. The horns are cylindrical, rather long, and curve round in front to point towards each other. They are excessively timid, and are generally seen feeding in the valleys, often about a large tank." Captain Gason observed them at a place called Nathongzoo, about 250 miles eastward of Moulmein.

This is doubtless the species which is also mentioned in one of Colonel Hamilton Smith's letters to me, as a "Wild Ox, inhabiting to the eastward of the Boorampooter, and very different from the Gaour and Gayal. It is simply described," writes Colonel Smith, "as a fine-limbed and deer-like animal of great size, and of a bright bay colour, exceedingly like a Devonshire Ox, very active, fleet, shy, and watchful; living in small herds in the wooded valleys, with watchers on the look out, who utter a shrill warning sound on the least alarm, when the whole dash through the jungle with irresistible impetuosity." He elsewhere mentions their having white horns; and in Pennant's 'Hindostan,' I remember a notice of a wild species with white horns occurring somewhere further to the Eastward; this same work containing also the earliest mention of the Banteng of Java.

In a late number of the 'Bengal Sporting Magazine,' (for 1841, p. 414,) we are informed, respecting the Burmese Wild Cow, or '*Sine Bar*,' that "herds of thirty and forty frequent the open forest jungles [of the Tenasserim Provinces.] They are noble-looking animals, with short curved horns, that admit of a beautiful polish. The cows are red and white, and the bulls of a bluish colour. They are very timid, and not dangerous to approach. Their flesh is excellent. They are the only cows indigenous to the provinces:" yet the preceding paragraph mentions—"The Bison" (Gaour) as attaining a great size in the East.

One more quotation *apropós* to the foregoing observations, and I shall have done. Mr. Crawfurd informs us, that "The Ox is found wild in the Siamese forests, and exists very generally in the domestic state, particularly in the southern provinces. Those we saw about the capital were short-limbed, compactly made, and often without horns, being never of the white or grey color so prevalent among the cattle of Hindostan. They also want the hump over the shoulders which characterizes the latter. They are used only in agricultural labour, for their milk is too trifling in quantity to be useful, and the slaughter of them, publicly at least, is forbidden even to strangers. Hence, during our stay, our servants were obliged to go three or four miles out of town, and to slaughter the animals at night. The wild cattle, for the protection of religion does not extend to them, are shot by professed hunters on account of their hides, horns, bones, and flesh, which last, after being converted into jerked beef, forms an article of commerce with China."—*Mission to Siam and Cochin China, page* 431.*

From Dr. Wallich, the Society has received another specimen of *Paradoxurus typus*, recent.

From P. Homphrey, Esq., a recent young specimen of *Pteromys Oral*, Tickell, procured at Midnapore.

From T. H. Maddock, Esq., Secretary to Government, four heads of Rhinoceroses, from Tenasserim; two of them belonging to the common Indian species *(Rh. Indicus)*, and the others to the oriental double-horned Rhinoceros *(Rh. Sumatrensis)*. The fact of all three of the Asiatic species of this genus inhabiting the Tenasserim Provinces was first made known in Dr. Helfer's list of the animal productions of that region, published in *J. A. S.* VII. 860; and that "a double-horned Rhinoceros is said to have been seen by the natives in the neighbourhood of Ye," is stated in the 'Bengal Sporting Magazine' for August, 1841; where, however, it would accordingly appear to be much rarer than the single-horned, "of which latter several have been shot by Europeans. They frequent the large jungles to the Eastward, but are more often met with in the jungles South of Ye." According to Dr. Helfer, it would, on the contrary, appear, that the double-horned is the prevalent species in that range of territory. "The *Rh. Indicus*," he informs us, "is found in the northern parts of the provinces, in that high range of mountains bordering on Zimmay, called the Elephant's-tail Mountains; the *Rh. Sondaicus* occupies the southernmost parts; while the *Rh. Sumatrensis*, or double-horned species, is to be found throughout the extent of the territories from the 17° to 10° of latitude." Now, from what is known of the habits of these animals, it is probable that the *Rh. Sondaicus* will prove to be the principal mountain species, though by no means limited to the mountains. In Java, according to M. Reinwardt, this animal "is found everywhere in the most elevated regions, and ascends, with an astonishing swiftness, even to the highest tops of the mountains" (*vide* 'Edinburgh Philosophical Magazine,' XIII. 34); and Dr. Horsfield notices, that "it prefers high situations, but is not limited to a particular region or climate, its range extending from the level of the ocean to the summits of mountains of considerable elevation.*** Its retreats are discovered by deeply excavated passages, which it forms along the declivities of mountains and hills. I found these occasionally of great depth and extent." This species is also an inhabitant of Borneo, where it is styled *Bodok*; but, according to Sir Stamford Raffles, ('Linnæan Transactions,' XII. 269,) it does not appear that a single-horned species inhabits that part of Sumatra with the productions of which he was best acquainted; "and the single horns which are occasionally procured, appear to be merely the larger horns of the two-horned species separated from the small one;" this, however, may be doubted now that the *Rh. Sondaicus* has proved to be common to Java and Tenasserim, and it appears probable, that while the latter only inhabits Java, it will be found to exist together with *Rh. Sumatrensis* in Sumatra, as both of these are said to be found together with the Indian species in Tenasserim. Whether more than one exists in Borneo we have at present no data for forming an opinion, and the discovery of the formerly supposed exclusively insular species on the Burmese mainland, casts a doubt upon which is the Chinese species noticed by Du Halde to inhabit the province of Quangsi, in latitude 25 degrees.

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* It is difficult to comprehend what animal can be meant by the Gyall of Bishop Heber's *Journal*, briefly noticed, and very rudely figured, as having been seen by that prelate in the Governor's Park in Ceylon; and equally difficult to understand what the following passage alludes to, in Mrs. Graham's work. At the Governor's house in Ceylon, this lady "saw, feeding by himself, an animal no less beautiful than terrible,—the wild bull, whose milk-white hide is adorned with a black flowing mane." Let me mention here, also, that there is a wild race inhabiting Madagascar that merits investigation. In Mr. Ellis's History of that Island, we read, that—"horned cattle are numerous, both tame and wild: many of the latter resemble, in shape and size, the cattle of Europe," whereas the domestic are all humped like those of India. Pennant notices this wild Madagascar race by the name of *Boury*. There is also some animal bearing the appellation of "Wild Cow," which is met with in herds on the route from Agra to Barelly; and there are many wild humped cattle, of the common Indian species, said to be merely the descendants of domestic individuals, found in herds in certain of the jungles of the province of Oude, which are extremely shy and difficult of approach, and are of some interest as solving the problem in the affirmative as to whether the Zebu could maintain itself wild in regions inhabited by the Tiger (vide *Journal of the Asiatic Society*, IX. 623, and *Transactions of the Agricultural and Horticultural Society India*, VII. 112.

From M. J. Athanass, Esq., the Society has received a head, with the skin on, of the great Jerrow Stag of the Himalaya (*Cervus Aristotelis*), which I exhibit together with a very fine head of the Sambur of India generally (*C. hippelaphus*). On comparison, it is seen that the former is of a lighter colour, with the hairs more conspicuously tipped with pale fulvous or yellowish-brown; but there is little marked difference between the specimens that would induce a suspicion that they appertained to different species, although the Jerrow is somewhat broader in the forehead, and its antlers are more divergent. Had these antlers belonged to a fully mature animal, however, they would have exhibited a size such as is never attained by those of the Sambur; a magnificent pair in the Museum of the Hon'ble Company in London are nearly four feet in length; whereas it is rare that those of the Sambur exceed two feet and a half. This I am enabled to assert with more confidence, since I have examined numerous bales of Stag-antlers imported from this country, in the hope of discovering among them some belonging to new or little known species; but I have invariably found these packages to consist solely of those of the Sambur and spotted Axis, generally in about equal proportion, and have never once thus met with a specimen of a Sambur antler that approached in magnitude to that of an adult Jerrow. Mr. Hodgson has distinguished these species in the Society's Journal, (I. 66,) together with another which I am enabled to state positively is the *C. niger* of Prof. de Blainville (*Bull. des Sc.* 1816), and which is styled by Mr. Hodgson *Rusa Nipalensis*. The latter naturalist has supplied representations of the antlers of all three species, which are published in the Journal of the Asiatic Society, I. 115. "The Nipalese," he remarks, "distinguish them with reference to the different shades of their, in general, uniform dark colour, by the epithets *Phusro*, *Râto*, and *Kâlo*, or grey, red, and black, *Jarai* [Jerrow.] The Phusro is the largest, being not less than a Horse in size; and has his dark hide copiously sprinkled with *phusro* or hoary. The Râto is the next in point of size, and is of a redder hue. The Kâlo is the smallest, and of a shining clear black. * * * All but the Kâlo species have a subterminal, as well as a brow antler" M. Blainville described his *C. niger* from a drawing which he saw at the India House, together with certain other drawings upon which he has founded his *Capra cossus*, *C. imberbis*, &c., and although these drawings could not then be found when I applied to see them some two or three years ago, I have since met with duplicates of them among those of the late Dr. Buchanan Hamilton, in charge of Dr. Wallich, marked, too, as having been (i. e. the originals) delivered at the India House in 1806, and the names are in Dr. Buchanan Hamilton's own writing which have been adopted by M. Blainville, except that the Goats are better styled *Capra Ægagrus Cossea* and *Ægagrus imberbis*, being clearly and obviously mere varieties of the common domestic species. The colour of *C. niger* (Buchanan Hamilton and Blainville) is represented brownish black, and the antlers, in accordance with Mr. Hodgson's description, have no subterminal branch or tine; indeed they so nearly resemble the figure in the Society's Journal, X. 722, that it might be supposed that both were drawn from the same individual.

With respect to the *C. equinus* of Colonel H. Smith, (which is not the Malayan species so denominated by Baron Cuvier,) if it really differ from the Sambur, it is probably the *C. Leschenaultii* of Baron Cuvier ('Ossemens Fossiles', IV. 32.) I have examined and possess figures of the frontlet of the identical individual described and figured from life by Colonel Smith, which is now preserved in the Museum of the London Royal College of Surgeons. The antlers measure two feet four inches in length, and eight inches round above the burr, with a brow-process fourteen inches long; their widest portion apart is twenty-two inches and a half, the tips returning to twenty inches, and those of the upper tine to fourteen inches; they have a differently granulated surface from ordinary Sambur and Jerrow antlers, being angulated and prickly instead of smooth to the feel, however coarsely tuberculated may be the others; and the tail of the animal is represented in Colonel Smith's figure to be slender and not bushy, in lieu of presenting that appearance which in the others has been compared to the tail of a docked horse that has been neglected*; the caudal disk, likewise, would appear to be more conspicuously developed, though it is doubtful whether either of these characters is of constant or normal occurrence: still it is worthy of remark that Colonel Sykes, in his Catalogue of the Mammalia of the Dukhun, ('Proceedings of the Zoological Society,' 1831, 104,) considers the large Rusa Stag which "abounds about the ghâts of Dukhun and in Khandesh as no doubt the same as the Malayan Rusa figured in Griffith's work. It wants the size of the *C. Aristotelis* [*Hippelaphus*] of Bengal, and is not so dark in colour"; and it should be observed that *C. Leschenaultii* of Cuvier was received from the Coromandel Coast. But Mr. Walter Elliot, in his recent Catalogue of Mammalia in the Southern Mahratta Country, ('Madras Journal,' No. XXV, 220), asserts, that "there is only one species of

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* This difference might depend, however, upon the animal being then, perhaps, shedding its coat.

Rusa found in the western forests, which is common also to all the heavy jungles of Southern India." None of the descriptions given by Hamilton Smith to the different Indian species under the names of *Hippelaphus*, *Aristotelis*, *Equinus*, apply exactly to it, but I have little doubt that all three are varieties of the great Indian Stag referred to *Hippelaphus* of Aristotle by M. Duvaucel, and to which it is not improbable that the *C. unicolor*, or *Gona* of Ceylon, is likewise referrible, &c." For my own part, I had an opportunity of examining several pairs of antlers of the peninsular animal while at Madras, and I considered them to be genuine Sambur, and I much incline to agree with Mr. Elliot in the opinion that there is probably but this one species of the group inhabiting Peninsular India, though it is quite certain that there are two others in the northern hills, as was first satisfactorily shewn by Mr. Hodgson.

From Lieutenant Tickell, a highly interesting collection has been received of specimens procured at Chyebassa; viz.

Cheiroptera: Twelve skins, referrible to five species; viz. a *Rhinolophus*, two specimens; *Vespertilio pictus*, four specimens*; another and much larger species, allied in its colour and markings to the preceding, but very different in the quality of its fur, three specimens; a small dark species, apparently the same as is very common about Calcutta, two specimens; and a beautiful *Scotophilus*, of a bright golden fulvous colour on the under-parts, one specimen. These I shall endeavour to determine as I find leisure to undertake the task, but the descriptions to which I have access are, for the most part, too meagre to permit of arriving at satisfactory conclusions from them.

Pteromys Oral, Tickell: five specimens; suggested by me on former occasions to be identical with *Pt. petaurista*, to which it is very nearly allied; but its size is inferior, and colour comparatively devoid of any rufous tinge. On comparing the skull, that of *Oral* is shorter and smaller, with the superior orbital margin and post-orbital process conspicuously less developed, the upper rodential tusks are directed more abruptly downwards, and the series of grinders are more than proportionally smaller. I have had the skulls prepared of both the adult and young *Pt. Oral.*

Cervus (*Styloceros*) *Muntjac:* a nearly grown female.

C. (*Rusa*) *Hippelaphus:* skin of a fine male, prepared for stuffing; but unfortunately too much injured by insects to be available for the purpose. The head of this specimen has already been noticed, and compared with that of the Himalayan Jerrow.

Tetraceros chickera: labelled *Antilope chickera*, and I believe correctly referred to that species of Major General Hardwicke, (*Lin. Trans.* XIV. 520,) though being a young kid, the species is difficult to determine with absolute certainty. The skeleton of the original specimen described by Hardwicke, and beautifully figured from life by Hill, is deposited in the rich Museum of the London Royal College of Surgeons: as often happens with captive sheath-horned ruminants, the blunt-tipped superficial sheathing which temporarily invests the harder permanent sheath of the horns of the young animal, had been retained in this adult specimen, which Dr. Leach not understanding, he was led to consider as belonging to a different species, the frontlet of a wild-shot specimen in the same collection, which he has styled *T. striaticornis.* A true second four-horned species, however, has been described by Walter Elliot, Esq.,

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* This occurs in the neighbourhood of Calcutta.—E. B.

('Madras Journal,' No. XXV. 225), as *Ant. subquadricornutus*, being characterized by larger size, and by having the anterior pair of horns scarcely developed, while the posterior pair is longer than in the preceding species. Both of these animals were known to me in England. The name *Chickera*, according to Mr. Elliot, is applied by all natives to the *Gazella Cora* of Colonel Hamilton Smith, which I have the authority of that learned naturalist for identifying with *Ant. Bennettii* of Sykes, rightly referred by Mr. Elliot to *A. Arabica* of Hemprich and Ehrenberg; though Colonel Smith's appellation takes precedence. The Museum of this Society contains a stuffed specimen of the kid of *G. Cora*, and numerous heads of adults; and I have seen many fine examples of the species, and among them a pair now living in Calcutta: nor is this the only species of true Gazelle inhabiting India. Mr. Gray has described, or at least named, a *Gazella Christii*, founded on a pair of horns obtained, if I remember rightly, in the Thurr, or great sandy desert north of Cutch, and deposited in the British Museum; and there is a stuffed specimen of the same species in the United Service Museum, received from Bombay, which satisfactorily establishes its existence. The *G. Christii* is a typical *Gazella*, inferior to *G. Dorcas* in size, and remarkable for its very pale colouring; the horns are smaller and much more slender than in *G. Cora*, less freely thrown out, and take the usual curve backward in this group, having the tips very abruptly bent inward. Proceeding westward, another species, the *G. subgutturosa*, inhabits Persia and the foot of the Caucasus; while *G. Dorcas* is found in Arabia in addition to *G. Cora*.

Respecting the present species, or *Tetraceros chickera*, a writer in the 'Bengal Sporting Magazine' mentions, that "it is found in the forests at the bottom of the Sivalik hills, and is considered a rare species: as the places it inhabits can only be beaten by Elephants, and this animal generally breaks cover at the distance of eighty yards, bounding off in a succession of short leaps, it is not very easily shot. The back pair of horns are about four inches, and the fore one inch and a half in length. This species," it is added, "is called *Chouka* or *Chousinga*, while *Chickera* is applied to either *subulata* or *acuticornis*."

Captain Brown states, in the same periodical, that—"The *Shikara*, a small antelope yet undescribed, is found in Hurriana; both sexes have horns, of a slender form without rings, and about eight inches in length; the animal is about half the size of the common Antelope [*A. Cervicapra.*] There is another Antelope also found in Hurriana, with slightly compressed horns, having rings, bending backward, and ten inches in length: both these species being unknown to naturalists." The latter is perhaps *Gazella Christii*, and the former doubtless identical with "an elegant small-sized Antelope, with horns in the females, numerous about Delhi;" as noticed by another observer in the same work.

These diminutive Antelopes of India are greatly in need of elucidation. In the Royal College of Surgeons, London, there exists a frontlet from this country, to which Prof. Blainville has assigned the name of *Ant. subulata*, and a single horn of another species, which he has designated *A. acuticornis*. These are described in Colonel Hamilton Smith's valuable treatise on the *Ruminantia*, published in the 4th volume of Griffith's English edition of Cuvier's 'Animal Kingdom,' and I possess original drawings of both specimens, which I shall take an opportunity of publishing in the Society's Journal.

Bos Gaurus.—The specimen prepared for mounting, as noticed in my last monthly Report to the Society, has since arrived, in a condition sufficiently uninjured to render it probable that we shall be able to set it up,—an undertaking which is now in progress.* The only portions injured are the forehead, which unfortunately has been partly denuded of its hair, and the back of the neck, which latter will however not be very observable in the stuffed specimen. If we succeed to my anticipations in mounting this enormous animal, it will certainly form a highly attractive object in the Society's Museum, and it will be the first example of the species which has been thus set up in any collection, as our skeleton of the same beast is likewise the first, and I believe still the only one, that any institution can boast of. Our late Honorary Curator, Dr. Evans, took with him, however, two skeletons of female Gaours to England, but had not succeeded in disposing of them when I left that country.

Manis pentadactyla, Lin.: a specimen remarkable for the unusual degree to which its hard scales have been worn down, probably from the narrowness of the rocky crevice that may be supposed to have led to its customary retreat, as those of the croup are thus ground away to the greatest extent. Moreover, the animal had lost one of its hind limbs, in consequence of which part of the weight of its body fell on the corresponding side of the tail, so that the series of lateral caudal scales on that side are so much rubbed away, that a sectional view of them is exhibited, wherein the expanded inferior surface no longer exists, and the apical point of each scale is considerably above and extends laterally beyond the side-angle. The general colour of this specimen is browner, or less glaucous, than is usual in the species.

Our Museum contains two other strongly characterized species of (presumed) Oriental Pangolin, of which one is, I suspect, undescribed.

For a long while, two species only were generally recognised of this genus,—the Long-tailed and Short-tailed Pangolins, or *Manis tetradactyla* and *M. pentadactyla*, Auctorum, which Cuvier was the first to refer distinctly to the continents of Asia and Africa respectively. The judicious Pennant, however, in the last edition of his 'Quadrupeds,' referred to an animal killed in Tranquebar, as described and figured in the 60th Volume of the 'Philosophical Transactions,' as probably representing a distinct species, which I think there can be no reasonable doubt of. M. Desmoulins has also described one, in his 'Mammalogie,' as *M. Javanica*: and the Cape species has been distinguished by Mr. Smuts, in the 'South African Journal,' as *M. Temminckii*, since more fully described and compared with its then known congeners by the late accomplished Secretary to the Zoological Society, Mr. Bennett, in the 'Proceedings of the Zoological Society', 1834, 81. Mr. Hodgson, next, described the Nepalese species as distinct from the currently admitted Indian one, by the appellation *M. auritus*, in the Journal of this Society, V. 234; but it is clear that he misapprehended the meaning of the description of the Indian species in Griffith's Catalogue, where the expression "eleven longitudinal series" of scales is intended to signify the central and successive lateral ranges, counting obliquely down each side of the body. The identification of Mr. Hodgson's alleged species with the ordinary Short-tailed Pangolin, Auctorum, has already been announced by Mr. Ogilby, in the Zoological Memoir annexed to Dr. Royle's 'Illustrations of the Botany, &c. of the Himalaya

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* And which has succeeded beyond expectation.—E. B.

Mountains'. Unquestionably, it is the species described as ***Manis pentadactyla*** in Shaw's 'Zoology,' I. 81, and it is as clearly the ***Manis Indica,*** v. ***pentadactyla,*** Lin. of M. Lesson, in the *Dict. Class. d'Hist. Nat.*, where the following synonyms are appended; ***M. brachyura,*** Erxl., ***M. macroura,*** Desm., and ***M. crassicaudata,*** Geoffroy: but the "Pangolin" of Buffon (*Hist. Nat.*, X. 187, pl. XXXIV), as distinguished from his "Phattagen," is obviously a distinct species from any now recognised; and the passage which that illustrious naturalist quotes from the traveller Desmarchais, and which has been copied by every subsequent writer on this genus, descriptive of a species called *Quogelo* by the Negroes of Guinea, which is said to attain to eight feet in length, of which the tail measures four, very clearly denotes another species of Pangolin as yet unknown to modern cultivators of Zoology. The differences of Buffon's "Pangolin" from the ordinary species of this country, is noticed in the first volume of the 'Asiatic Researches' (p. 376), where a figure is given of the Indian animal, and there is a notice of its anatomy in the second volume of the same work (p. 353), but containing no details elucidative of specific distinctions. Dr. Cantor informs me, that the geographic range of this species extends eastward to Chusan; and Pennant quotes Dahlman (in *Act. Stockh.* 1749, 265), noting its existence in China, where it is termed *Chin Chian Seick*, and also mentions its occurrence in Formosa. In Assam I have been informed that there are Pangolins of very large size, in all probability a distinct species: and from the same region a still more interesting species of edentate animal may be looked for by zoologists.

With these preparatory observations, I now proceed to notice a species which appears, so far as I can find, to be undescribed; but I regret to add that I have been unable to learn its native locality. It approaches very near to the "Phattagen" of Buffon, or Long-tailed Pangolin of Africa, but has the tail considerably less elongated than in that species, though more so than in any other known to systematic Zoology. I shall designate it *Manis leptura*. Length of the specimen thirty-nine inches, of which the tail measures eighteen, and the head four; on each foot are five claws, the innermost on the fore-feet minute: although considerably larger than two specimens before me, which I refer to *M. Javanica*, the claws on its fore-feet are smaller and more curved, while those on the hinder are longer: in (presumed) *Javanica*, the middle fore-claw, though worn at the tip, measures fully an inch and three-quarters, and the next externally one inch and three-eighths; whereas the corresponding measurements in the new species are one inch three-eighths, and one inch: but on the hind foot, the middle claw of *Javanica* scarcely exceeds three-quarters of of an inch, and the next externally is under five-eighths of an inch; while in the new species these measure, respectively, an inch and a quarter, and one inch: following out the comparison, the head of *leptura* is considerably more slender and elongated, measuring two inches and three-eighths from eye to snout, and having no trace of ear-conch; in *Javanica* there is a distinct ear-conch, and the distance from eye to snout is but an inch and five-eighths; the animal, however, being considerably smaller, though not in that proportion. In *Javanica,* the scales upon every part are comparatively uniform in size, and there is no abruptly marked difference of dimensions between those of the head and neck; in the new species, as in *pentadactyla,* those of the head are very much smaller: in the former, the lateral scales of the body are strongly carinated, while in the latter they are but very slightly so indeed: the scales on the fore-limbs are much smaller, more numerous, and differently disposed, in the new species from what they are in *Javanica*, appearing as hexagons instead of lying in quincunx order; on the hind-limbs the same diversity exists, but is less strongly marked. Protruding from beneath every scale of *Javanica* are seven or eight conspicuous bristles; while in *leptura* one or two only can be discerned here and there, scarcely more than in *pentadactyla*. The number of series of scales consists in *leptura* of nineteen, and in *Javanica* of seventeen; the central row from the occiput to the tail-tip of the former consists of fifty-three, to which may be added ten upon the head. Lastly, the under-parts are less hispid in *leptura* than in *Javanica*, and the tail is both narrower and longer. The general colour of the scales in *leptura* is deep rufous-brown, while those of *Javanica* are blackish-brown, and of *pentadactyla* whitish or glaucous-brown. In the specimen now presented, however, of the latter, as before remarked, the colour of the scales is darker and less glaucous than usual.*

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* Since the above was written, the extremely interesting account of the ordinary Indian Pangolin, by Lieutenant Tickell, has appeared in the *Journal (ante*, p. 221, *et seq.)*, and the analogies presented by this animal and the Great Anteater *(Myrmecophaga jubata)* of South America, of which so interesting a notice has been published by M. Schomburgk, (*P. Z. S.* 1839, 24,) are worthy of being studied.

The retension of the fœces was observed in both instances; and M. Schomburgh supplies us with a hint as to what food the Pangolin may not improbably be maintained upon in captivity. Of an adult *Myrmecophaga*, he writes: "It began to feed on the third day; we gave it ants and farina; the latter, a preparation of cassada root, it never refused. The ant's nests in the neighbourhood were soon exhausted, and more by way of experiment than out of persuasion that the animal would eat it, some small pieces of fresh beef were placed before it; to our greatest astonishment it ate the meat with avidity, and has since been chiefly fed on fresh beef and fish. We observed that in the course of three weeks it evacuated only twice, and then very copiously; this was likewise the case with the young one; and before I noticed the same circumstance with the adult, I thought its death was partly caused by constipation." So, likewise, in Lieutenant Tickell's Pangolin, after it had fasted several days, "there was a quantity of the remains of ants in its stomach, and the rectum was full of fœces."

The *Myrmecophaga* "secretes a liquid substance, transparent like water, which drops almost constantly out of its nostrils and mouth; this is the more remarkable, as it used very little water." It does not appear that the same was noticed of the Pangolin.

The prodigious strength of both animals is sufficiently attested by the osseous and muscular conformations subservient to its display.

Both raise themselves on the hind legs to reconnoitre; but the *Myrmecophaga* exhibits the more usual structure having reference to this habit, as it possesses plantigrade hind-soles; while the weightiness of the tail may be inferred to afford considerable aid to the Pangolin in enabling it to maintain those remarkable attitudes observed by Lieutenant Tickell. While the latter creature, however, would appear to be wholly incapable of active defence, the former rises on its haunches, and strikes with the sharp claws of one of its fore-feet at its enemy, while the other remains pendent, and only in cases of great danger throws itself on its back, and strikes with both fore-feet, or embraces with its fatal hug. The little two-toed Anteater has likewise been observed to defend itself by striking with one of its fore-limbs.

The very curious little animal last noticed has been ascertained to feed on the nymphæ of arboreal *Hymenoptera*, which it seizes with great address by means of its nipper-like fore-claws; and M. Schomburgh relates, of the Great Anteater, that—"It attempted frequently to take up objects with its paws; in which manœuvre its long claws assisted wonderfully. * * * It climbed up the palings of its pen with great agility, never using both of its arms at a time, but first one and then the other; and if it had taken hold sufficiently with its claws, it raised the whole body, and brought up the hind-feet. We may conclude from this fact upon the strength of the muscles of its fore-limbs. The great muscle of the arm, of one which we dissected, was two inches wide, and three-eighths of an inch thick.

Among the specimens procured in the neighbourhood, I shall only notice *Pachysoma marginatum*, which I find is of common occurrence in this vicinity.

AVES.

Lieutenant Tickell's Birds consist of 120 specimens, which are referrible to eighty-one species, twenty-seven of which are new to the Society's Museum, and have enabled me to identify many of those described by Major Franklin and Colonel Sykes, (in the 'Proceedings of the Zoological Society' for 1831 and 1832.) I distinguish such as are new to our Museum by an asterisk.

Palœornis Alexandrinus: female.

P. torquatus, ditto.

Falco luggur, Jerdon, ditto.

F. tinnunculus.

* *Aquila Vindhiana,** Franklin, *P. Z. S.*, 1831, 114.

* *Spizætus* (Vieillot) *albogularis*, Tickell; genus *Nisüetus*, Hodgson, *J. A. S.*, V. 228. Length twenty-two inches, or rather more, of wing from bend sixteen inches, and tail ten inches; bill over curve (including cere) one inch and three-quarters to forehead, and one inch and five-eighths from point of upper mandible to gape; tarse three inches, and feathered to the toes. General colour of the upper parts black, with a shade of brown; the nuchal feathers white at base, and the occipital prolonged to form a crest two inches and a half in length: throat, fore-neck, and breast pure white, the sides of the last having a narrow black central streak to each feather: belly, flanks, under tail-coverts, fore-part of the under-surface of the wings, and plumage of the legs, deep rufous, darkest on the lengthened tibial feathers, and streaked longitudinally with black on the sides, the posterior feathers of which (under the wing) are wholly dusky-black; rest of the wing albescent underneath, the terminal portion of the primaries, beyond the emargination of their inner vanes, barred inferiorly with black, and chiefly on the inner vanes, the outer but very faintly so; and tail brownish above, the central feathers darkest, and albescent like the wings on its under-surface, which

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"I have already remarked how fond the young one was of climbing, and this, coupled with what I have just now related, makes me not doubt that, if circumstances should require it, they climb trees in the wild state with the same agility."

The mode of walking upon the knuckles, with the claws bent upwards and inwards to the leg, is common to both genera, though confined to the fore-feet in *Myrmecophaga*, whereof the trenchant claws are however better protected, being received into a groove, while a callous pad projects to increase the surface upon which the animal treads. The fossil genera *Megatherium*, *Megalonyx*, and *Cœlodon*, would appear to have advanced on the ground in the same manner as their recent allies the *Myrmecophagæ*, being intermediate to these animals and the Sloths, and especially, it would seem, approximating the diminutive two-toed Anteater; and as this South American group is represented in the Old World by the Pangolins, which likewise have enormous fossil congeners, so the other great American group of Armadilloes, with their huge fossil allies (the *Hoplophorus*, Lund, vel. *Glyptodon*, Owen, &c.), is represented in Africa by *Orycteropus;* and who shall say, when the fossil treasures of that grand continent shall have been exhumed, what mighty creatures of the past bearing that affinity to the existing *Orycteropus*, which the giant Pangolins and huge *Edentata* buried in other continents do to their existing analogues of the same regions, may once more glory in the light, to uphold the classic fame of Africa as the "land of monsters?"

* I regret to add that this and several other specimens have since been utterly destroyed by the *Dermestes*, their skins not having been poisoned, while other and poisoned skins that were with them have totally escaped injury.—E. B.

has a series of narrow dusky bands indistinct on the outermost feathers, and successively more developed to the central; above, these bands are also seen, but obscurely: the ear-coverts are white towards the eye, and elsewhere rufous, each feather having a medial streak of black. "Irides dark; beak leaden-blue, its cere and base wax-yellow; toes yellow, and talons black," the latter large and powerful. The plumage of this fine specimen had been newly renovated, and a few of the old feathers remaining on the wings and among the upper tail-coverts are of a moderately dark brown colour, contrasting with the much darker or blackish hue of what is evidently the livery of maturity.

Circætus (Hæmatornis, Vigors,*) undulatus,* Vigors, *P. Z. S.*, 1831, 170, and figured in Gould's 'Century,' part I: male and female.

Circus melanoleucos: marked female, in dress precisely resembling that of the male. This species is not rare near Calcutta.

C. Swainsonii, A. Smith, *S. Afr. Journ.* 1831; *C. pallidus*, Sykes, *P. Z. S.*, 1832, 80: female.

Otus brachyotus.

Ninox lugubris; Strix lugubris, Tickell, *J. A. S.*, II. 572; *Ninox Nipalensis,* Hodgson, *Madras Jl.*, No. XIV. p. 23.

Athene Indicus; Noctua Indica, Franklin, *P. Z. S.*, 1831; 115; *Strix Brama,* Temminck.

**Ath. undulatus; Strix undulata,* Tickell, *J. A. S.*, II. 572. *Ath. erythropterus,* Gould, *P. Z. S.*, 1837, 136; *Noctua perlineata,* Hodgson: male and female.

Strix flammea.

**Buceros Malabaricus*: two fine specimens.

**B. gingianus*. two adults and a young specimen.

Coracias Indica: two specimens.

Merops viridis, v. *Indicus.*

* "*Bucco viridis,* Gmelin; *B. Zeilonicus,* Latham, Brown, *Ill. Zool.* pl. XV.; *Kettorea,* Vieillot; *B. Lathami,* Vieillot, *Encl. Method.*; *B. caniceps,* Franklin, *P. Z. S.*, 1831, 121." Jerdon, *Madras Jl.* XI. 217.

B. Indicus: two specimens.

Picus (Brachylophus) Bengalensis: male and female.

* *P. (Dendrocopus) Mahrattensis:* male.

—————— *nanus,* Vigors, *P. Z. S.*, 1831, 172: male.

—— *(Meiglyptes) badius:* female.

Centropus pyrrhopterus: female.

* *C. lepidus,* Horsfield, *Lin. Trans.* XIII. 180[†]. Length fourteen inches, of wing six inches and one-eighth, and middle tail feathers seven inches and three-quarters, exceeding the outermost by three inches and seven-eighths; bill to forehead one inch, and to gape one inch and a quarter; tarse one inch and three-quarters; long hind claw an inch one-eighth. General colour dark chestnut-brown above, pale fulvescent underneath, passing into white on the throat and belly; wings principally bright chestnut-rufous, and tail black, more or less rayed across with rufous. The plumage

of the upper-parts, to the inter-scapularies and scapularies inclusive, and of the lower parts to the breast inclusive, is of the usual character in this genus, having rigid and pointed shafts, which are yellowish-white, contrasting on the upper parts with a dusky border; while the feathers on the hind-part of the back, rump, and on the belly, are short and downy: scapularies indistinctly barred with dusky, as also the feathers on the sides of the neck and breast, the bars on these being contracted into spots: sides, tibial plumes, and under tail-coverts, fulvescent-white, and more distinctly barred with black. The specimen described is a young male, which had nearly assumed the adult plumage, but has a few feathers of the juvenescent garb remaining; the adult primaries and secondaries are thus shown to be uniform chestnut-rufous, while the immature are barred with black; and the adult tertiaries only differ from the primaries in being tinged with dusky: tail black, with a slight green shine, and tipped with whitish, the uropygials and upper coverts barred with rufous: rump dusky, tipped with rufescent and whitish, and belly pure white. "Irides carmine. Bill light horn: and legs dark leaden-blue."

[†] I have recognized this species from Dr. McClelland's drawing of an Assamese specimen transmitted to the India House, and referred by Dr. Horsfield to this species; the description above referred to being insufficient for the purpose

Macropteryx longipennis, Swainson; *Hirundo klecho*, Tem.: male.

Crypsirina vagabunda.

Pastor tristis.

P cinereus, Jerdon: two specimens.

**Edolius cærulescens.*

Lanius Hardwickii.

Graucalus Papuensis; G. Nipalensis, Hodgson, 'Indian Review,' I. 327: male and female.

Pericrocotus (Phœnicornis, Sw.*) princeps:* a male and two females.

Muscicapa melanops, Vigors, *P. Z. S.*, 1831, 171, and figured in Gould's *Century*, plate VI.

M. cærulea, Vieillot; *M. occipitalis*, Vigors, *P. Z. S.*, 1831, 97: female, being the *M. cæruleocephala*, Sykes, *P. Z. S.*, 1832, 85.

**M. picata*, Sykes, *P. Z. S.*, 1832, 85: two males. This species is erroneously identified by Mr. Jerdon with the *M. hirundinacea*, Reinwardt, v. *M. obscura*, Horsfield, *Lin. Trans.* XIII. 146, and figured by him in the 'Zoological Researches in Java'; but the latter is at once distinguished from it by having no white on the wings, nor on the sides of the neck; neither are any of its tail-feathers white-tipped. The African *M. picata* of Swainson was subsequently so named, and must consequently receive another appellation.

* *M. Poonensis*, Sykes, *P. Z. S.* 1832, 85.

* *Muscicapa* (?) *superciliaris*, Jerdon, *Madras Journal* No. XXVI. 16; *Dimorpha albogularis*, Nobis, *ante*, p. 190.

**Hirundo filifera*, Stephens; *H. filicaudata*, Franklin, *P. Z. S.*, 1831, 115; *Wire-tailed Swallow* of Latham.

Ixos jocosus: male and female.

——*pusillus; Hæmatornis* (Sw.) *pusillus*, Nobis, *Report* for last September, *J. A. S*, X. 841: male and female.

Chloropsis aurifrons, Jardine and Selby; *Chl. cæsmarhynchos*, Tickell, *J. A. S.* II. 577: two specimens marked female, and not differing in plumage from the adult male, further than that there is less yellow surrounding the black of the fore-neck. This handsome species is no despicable songster, and lives and sings well in confinement.

Iora typhia; I. scapularis, Horsfield; *Motacilla subviridis*, Tickell, *J. A. S.* II. 577.

**Parus xanthogenys*, Vigors, *P. Z. S.*, 1831, 92, and figured in Gould's 'Century,' pl. XXIX, fig. 1.

**P. Nipalensis?* Hodgson, *Ind. Rev.* II. 31 (*P. cæsius*, Tickell) : two males. This bird agrees minutely with Mr. Hodgson's full description, excepting in being a trifle smaller. Length about five inches, of wing two inches and a half, and tail two inches and a quarter; bill to forehead (through the feathers) seven-sixteenths of an inch, and to gape half an inch; tarse five-eighths of an inch.

**Dendrophila frontalis*, Swainson.

**Sitta castaneoventris*, Franklin, *P. Z. S.*, 1831, 121, and figured in Jardine and Selby's 'Illustrations of Ornithology,' pl. CXLV, the beak being represented much too short: male and female; the latter having the under-parts very much paler rufous than in the male. Although I entertain no doubt that this is the species indicated by Major Franklin, still our Museum contains a specimen of another species to which the Latin definition furnished by that gentleman equally applies. This latter is altogether a stouter bird, with the bill especially much broader, and not—as in the other—distinctly and conspicuously compressed for the basal two-thirds: length of wing three inches and one-eighth, and of tail an inch and three-quarters; whereas in the male and female *castaneoventris*, these measurements are respectively three inches and two inches seven-eighths, and an inch and a half. The *generic* markings and coloration are so similar, that really I do not see how the dry specimens can be further characterized apart; yet a glance suffices to shew their non-identity as species, and the one now indicated is considerably more allied to the British Nuthatch than is the other, which last displays a close affinity with *Dendrophila*, not observable in that with which I am comparing it. With respect to colour, the hues of *castaneoventris* are altogether softer and more delicate, and in both sexes the grey of the upper part of the head and neck is conspicuously paler than that of the back; whereas in the other, although the head and nape are seen, on particular inspection, to be somewhat lighter than the back, this would scarcely be noticed, unless attention were expressly directed to the observation. In *castaneoventris*, the upper tertiaries are uniformly bluish-grey, and in the rest there is no strongly marked distinction between the dusky of the inner web, and the grey external margin; but in the other species, the external blue grey contrasts abruptly with the black of the internal portion of the feather, which last, too, extends over a considerable part of the outer web, as is not the case in *castaneoventris*: this distinction may perhaps vary somewhat in amount of development in different specimens, but I suspect will always be found to prevail more or less decidedly. In the male *S. castaneoventris*, the colour of the whole under-parts, from the white throat to the mottled under tail-coverts, is of a deep dark ferruginous; while in the female it is not very much darker than in a British Nuthatch, having the fore-neck and breast a sort of dull isabelline hue tinged with ferruginous, and the belly and flanks darker and more deeply tinged with the latter. In the new species (sex unknown), the fore-neck, breast, and lower parts are uniformly coloured, and much paler than in the male *castaneoventris*, but deeper than in the female, being of a dull rusty cinnamon tint, with the throat and beneath the eye white, as in the others. I shall venture to designate this bird *S. cinnamoventris*.

A species is figured and described by Messrs. Jardine and Selby, *Ill. Orn.*, pl. CXI IV, as *S. Himalayensis*, which, if not the same, must be very closely allied to that described by Mr. Hodgson (in *Journ. As. Soc.* V. 779,) as *S. Nipalensis** ; the latter naturalist also describes an *S. corallina (loc. cit.)*, which would appear to border closely upon *Dendrophila frontalis*, and there is another *Dendrophila* adverted to by Mr. Swainson as *D. flavipes*, with which I am unacquainted. These are all the Indian species of the present group I as yet know of, and as many as three are now ascertained to inhabit Europe, besides several in North America.

Oriolus Hodsonii, v. Asiatic *melanocephalus* : a male in mature plumage, and one in second plumage, or that which succeeds to the nestling garb ; this second dress representing the *O. McCoshii*, Tickell, *J. A. S.*, II. 577, and being generally mistaken for the female livery of the species

Turdus unicolor, Gould, *P. Z. S* , 1837, 136, but not *T. unicolor*, Tickell, *J. A. S.* II. 577 ; which latter having been first bestowed, it is necessary to rename the present species, which I therefore propose to designate *T. modestus*.

**T. (Oreocincla*, Gould,*) parvirostris*, Gould, *P. Z. S.*, 1837, 136: two males.

Petrocincla Manillensis (?) ; Turdus Manillensis, Gmelin; *le Merle Solitaire de Manille*, Buffon, *Hist. Nat.*, *Ois.*, II. 363; *P. Pandoo*, Sykes, and the female *P. Maal*, Sykes, *P. Z. S.*, 1832, 87-8. Accordingly, this species would extend to the Phillipines, Tenasserim, and Peninsular India; but I am not yet certain that the Indian bird has ever any rufous on the under-parts. A specimen from Luçonia, which I adjudge to be a young male once moulted, has the whole upper-parts, throat, and breast, cyaneous, tipped with dusky-brown on the crown, with greyish—across, which passes a blackish bar—on the interscapularies, and with whitish—having a similar black bar—on the scapularies and small wing-coverts ; throat, fore-part of the neck, and breast, also broadly tipped with fulvous-white, having a black subterminal cross-streak ; belly, under tail-coverts, axillaries, and fore-part of the under-surface of the wings, deep ferruginous, the abdominal feathers broadly edged with whitish, having a narrow black subterminal band, and above this more or less cyaneous, especially on the flanks ; wings and tail dusky-black, more or less edged with cyaneous and whitish : in this state of plumage it is the *Turdus Manillensis*, Gmelin. A specimen from Tenasserim, minutely agreeing in all other respects, has the feathers of the upper-parts less bordered, the axillaries and under-surface of the wing have merely a few slight traces of the rufous colouring, which is replaced by cyaneous, the large under tail-coverts are partly of this latter hue, which is also considerably developed on the abdominal feathers, and almost wholly supercedes the rufous on the flanks. Another specimen from Tenasserim has but a very slight trace of rufous left towards the vent and bordering the under tail-coverts, being elsewhere wholly cyaneous, excepting the dusky black of the large wing and tail feathers, and the tips of some of the wing-coverts, which are whitish. Finally, the Chyebassa specimen is totally devoid of any rufous trace whatever, but has most of its clothing feathers slightly dusky-tipped, with minute pallid extreme tips, in which condition of plumage it accords with *P. Pandoo*, Sykes. A female, being the *P. Maal*, Sykes, before me, (locality unknown,) corresponds in plumage to the same sex of the Himalayan *P. erythrogastra*, but has the upper-parts of a dingy bluish grey-brown, the large wing and tail-feathers principally dusky, coverts more or less whitish-edged, and under-parts mottled with whitish, having a dusky black subterminal cross-band to each feather. In *P. erythrogastra*, the deep rufous tint of the under-parts of the male is permanent and constant, but in a very few, I have seen an additional slight rufous patch surrounded by the cyaneous of the fore-neck.

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* The Society has since received *S. Nipalensis* from Mr. Hodgson, and it is distinct.

**Motacilla variegata*, Latham, *Gen. Hist.* VI. 320; *M. picata*, Franklin, *P. Z. S.* 1831, 119: a male in summer and another in winter plumage.

Anthus arboreus.

Cinnyris Mahrattensis · adult and young

C. Sola · male.

Zosterops Maderaspatanus two males.

**Pyrgita flavicollis*. female.

**Amadina punctata* · young male.

**Estrelda formosa*; *Fringilla formosa*, Latham, *Ind. Orn.* I. 441, 23, as quoted in Shaw's 'Zoology,' IX. 466: male.

Erythrospiza—? (*rosea*, apud Hodgson). A species very different from the *E. rodopepla* and *E. rodochroa*, figured by Gould, and which is commonly sold alive by the dealers in Calcutta. I have now several living specimens of it. Lieut. Tickell names it *Pyrrhula roseata*, but I doubt much if a prior name might not be found, although I have myself been unsuccessful in satisfactorily determining the species. Length five inches and three-quarters, of wing three inches and a quarter, and tail slightly forked, its outermost feathers two inches and a quarter; bill to forehead above three-eighths of an inch, and considerably bulged; tarse five-eighths: general colour, in winter aspect of plumage, deep ruddy on the upper parts, passing into dusky-roseate on the forehead, rump, and upper tail-coverts; the nuchal feathers tinged with ashy, and the dorsal margined with dusky-olive; throat and breast roseate, paling below the belly, and lower tail-coverts rosy-white; wings and tail dusky, the feathers edged with ruddy-brown, a little albescent on the outer edge of the tips of the tertiaries; bill and feet horny. In summer aspect of plumage the feathers have lost their marginal edgings, the back appears greyish-brown, and the crown, throat, fore-neck, and rump, are brilliant crimson. The female is altogether olive-brown, paling below, and whitish on the belly; the wing-coverts and tertiaries are tipped with pale yellowish-brown, and the clothing feathers of the upper parts, excepting on the rump, with those of the fore-neck, breast, and flanks, are centred darker. Song a feeble twittering, but soft and pleasing, intermediate to that of the European Goldfinch and that of the small Redpole Linnet; the call-note much resembles that of a Canary-bird, which group indeed this species nearly approximates in its conformation.

Columba Javanica: an injured male.

C. (Alsocomus) puniceus, Tickell: six specimens. A splendid species of Dove, allied to the last, and also nearly related, it would seem, to the Javanese *C. lacernulata* of Temminck; but differing from that species, as described, by having dusky-black upper tail-coverts, in the bill not being "wholly black," but vinaceous-purple at base with a greenish-yellow tip, and presenting some other minor discrepancies. Length fifteen inches and upwards, of wing eight inches and three-quarters, and tail six inches and a half; bill to frontal plumage three-quarters of an inch, and tarse seven-eighths of an inch. " Irides orange with a red outer circle ; feet dull lake." General colour rich and deep vinaceous-brown, having the whole top of the head, including the occiput, whitish-grey; primaries and secondaries, with the coverts of the primaries, winglet, and tail and its coverts, black, most of the large wing feathers inclining to grey towards their margins; rump also black, the feathers margined with glossy dark amethystine-purple; interscapularies broadly edged with the same, changeable to green, which latter predominates, while a reddish gloss prevails on the edges of the scapularies and wing-coverts; throat paler in some specimens, and the under-parts generally less glossy than those above.

Gallus Bankivus: male and female. The latter remarkable for bearing powerful spurs, which is very unusual in this sex.

Francolinus vulgaris: two males and two females. The *Perdix Hepburnii* of Gray, with its alleged variety, appear to me to be meant for females, or perhaps young males, of this common species.

—— *Pondicerianus:* male and female.

*——*Northiæ; Polyptectron Northiæ*, Gray and Hardwicke: female. Length eleven inches and a half, of wing five inches and a half, and tail three inches and five-eighths; bill to forehead three-quarters of an inch, and to gape seven-eighths of an inch; tarse one inch and a half. " Irides dull orange, bill horn-coloured, legs and feet vermillion." Space between the bill and eye almost nude, and deep coral-red in the dry specimen. All the upper parts rufous-brown, with two or three black bands on each feather, beyond the last of which the tip of the feather is less rufous; there is also a number of minute black specks on each plume, in addition to the bands; rump and upper tail-coverts minutely freckled; the tail-feathers chiefly blackish, with mottled rufous bars tending to become obsolete; primaries, their coverts, and the winglet, spotless dusky; crown blackish and subcrested; the neck olive-brown, albescent on the throat; on the lower part of the fore-neck the feathers become rufous in the centre and tipped with black, being laterally margined with olive-brown; and on the breast and flanks they are bright ferruginous with narrow black tips, somewhat like those of an English cock Pheasant; belly fuscous-brown, and under tail-coverts resembling the upper; wings and tail dusky underneath. The *Perdix oculea* of Hardwicke and Gray would seem to be nearly allied to this species.

Coturnix dactylisonans: three specimens.

C. textilis, Tem.: a female.

**Hemipodius Dussumieri.*

Cursorius Asiaticus.

Pluvianus Goensis: two specimens.

P. bilobus.

Limosa melanura.

Totanus ochropus

Anastomus typus, Tem., young.

Ardea Javanica : adult and young.

**Porzana Akool: Rallus Akool*, Sykes, *P. Z. S.*, 1832, 164.

**Mergus serrator :* female.

Sterna seena, Sykes.

**Carbo albiventer*, Tickell; female. Length about twenty-nine inches, of wing eleven inches, and tail (consisting of fourteen feathers,) seven inches; bill to forehead (in a straight line) two inches and a half, and to gape three inches and seven-eighths; tarse two inches and a half; longest toe and claw three inches and three-quarters. Colour of the whole under-parts white, but apparently changing to dusky on the fore-neck and breast; flanks dusky brown; upper-parts dingy dark-brown, but a number of new feathers appearing on the scapularies and shoulders of the wings, dark silvery grey with a moderately broad black margin, analogous to what is observed in various other species; feathers of the crown and sides of the neck slightly margined laterally with whitish; bill dusky above, the rest pale; gular skin yellow, and feet and membranes black.

From M. M. Liautaud (Chirurgien de Marine) and Reymoneng (Elève) of His French Majesty's Corvette, the *Danaide*, I have to announce the presentation of a collection of bird skins and of shells from various regions; the former consisting of, firstly, the following European species, killed in France —

**Alcedo ispida.*

**Turdus torquatus*. female.

Oriolus Galbula, ditto.

Sturnus vulgaris.

**Charadrus pluvialis.*

From Panama (Republic of New Granada),

**Tanagra episcopus.*

From Chili (neighbourhood of Valparaiso),

**Turdus Magellanicus*, Vigors, *P. Z. S.* 1830, 14; being a new locality, I believe, for this species, which is allied to the well known Robin Thrush of North America.

From Bone Bay, in the Caroline Islands,

**Ptilinopus purpuratus*, Swainson: the example of which most elegant species, heretofore known as an inhabitant of O Tahiti, has unfortunately been denuded by insects of the skin of the fore-part of the forehead and throat.

From Luçonia, of the Philippines,

Petrocincla Manillensis: being the specimen before noticed in my account of the collection of bird-skins presented by Lieutenant Tickell.

**Ceblepyris cœrulescens*, Nobis. Length nine inches and a half, of wing four inches five-eighths, and tail three inches and a half; bill to forehead (through the feathers) fifteen-sixteenths of an inch, and to gape an inch one-eighth; tarse three-quarters of an inch: fourth, fifth, and third primaries successively longest; outermost tail-feathers not half an inch shorter than the middle ones. Colour of the upper parts black, the feathers edged with bluish dusky, paler on the forehead, and inclining to greyish on the rump; tail and greater wing-feathers wholly black. lower parts uniform dark greyish-dusky; the tips of the outermost tail-feathers paler underneath. bill and feet black, as are also the lores.

From Captain C. S. Bonnevie, of the Norwegian Royal Navy,—

Specimens of *Lophastur**, Nobis, n. g? Allied to *Pernis*, but wanting the peculiar character of that genus, the loral feathers resembling those of most other *Falconidæ:* beak also distinctly, though feebly, toothed; and the cere much less developed than in *Pernis:* talons very feeble, and the anterior tarsal scales but semi-reticulate. Rest as in *Pernis*, and the medial occipital feathers elongated, as in *P. cristatus*, Cuv., v. *Falco ptilorhynchus*, Tem.,—as also in the genera *Hyptiopus*, Hodgson, v. *Lophotes*, Lesson (pre-occupied in Icthyology), v. *Lepidogenys*, Gray, and *Spizætus*, Vieillot, v. *Nisætus*, Hodgson.

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* This may possibly be the genus *Buteopernis* adverted to by Mr. Jameson, in *Calc. Journ. Nat. Hist.*, No. III. page 320

**P. Jerdoni*, Nobis: adult and young. Length about eighteen inches or nearly so, of wing twelve inches and a half, and tail nine inches; bill, over forehead, including cere, an inch and a half, and from point of upper mandible to gape an inch five-eighths; greatest vertical depth about five-eighths of an inch, and arcuation (as in *Pernis*) very moderate; tarse anteriorly one inch and three-quarters, having the upper half feathered; middle toe and claw two inches, the latter barely exceeding three-eighths of an inch, and hind claw little more than half an inch. Lengthened occipital feathers of a spatulate form, and two inches and a quarter long in both specimens. Plumage of the adult, on the upper-parts, of a hair-brown colour, each feather broadly terminated with dusky-brown, having a fine reddish-purple gloss, which terminal portion is alone externally visible on the back and scapularies; primaries, secondaries, and tertiaries, crossed with a few bars of the same, and the latter edged at the tip with whitish; tail light hair-brown, with a broad subterminal dusky band, and three successively smaller ones, likewise successively less distant to the base; its extreme tip whitish beneath, the wings and tail are whitish-grey, with only the terminal bands as much developed as above. Lengthened occipital plumes dull black; and the nape and sides of the neck rufous-brown, with a medial dusky streak to each feather, more or less developed. Lower-parts whitish, somewhat broadly banded across below the breast with rufous-brown; the sides of the breast rufous; and a mesial line on the throat, fore-neck, and breast, composed of feathers which on the throat are almost wholly blackish, becoming less deep and mingled with rufous on the fore-neck and breast, where laterally margined with white. Beak horn-coloured, with a pale cere; and legs have probably been yellow. The young merely differs in having each feather of the upper-parts slightly margined with whitish, and those of the lower-parts are analogous to the immature plumage of the genus *Accipiter;* the mesial dark streak flanked with whitish may be traced almost to the vent, and this is merely the same, further developed, as exists upon the throat of a common Indian species of *Accipiter*, viz. *A. Dussumieri*, v. *Dukhunensis* of Sykes. I dedicate this handsome species to a naturalist to whose persevering researches students of Ornithology in this country are deeply indebted, and whose investigations, I am happy to say, now extend throughout the series of the animal kingdom, and may be expected to add considerably to our information on the Zoology of India.

Picus leucogaster, apud Horsfield, Catalogue of Javanese Birds prefixed to 'Zoological Researches in Java': *P. Javensis*, Horsfield, *Lin. Trans.* XIII. 175; but not *P. leucogaster*, Reinwardt, apud Bory, *Dict. Class. d'Hist. Nat.* XIII. 507, if the size be there correctly stated; the breast, too, is described as "noire, rayée de roussâtre," but this may be the case in some specimens, as a few of the pectoral feathers of a female in the Society's Museum have slight rufous-white edgings, and the colouring of the female bird is otherwise correctly enough described by M. Bory.

Dr. Horsfield strangely describes the *P. pulverentulus*, Tem., as the female of this species, but we now possess both sexes, and the female only differs from the male in having no crimson moustache, nor on the crown but only on the occiput. This fine species is closely allied to the *P. Hodgsonii*, Jerdon, *Madras Journ.* vol. XI. 215, and there admirably figured, but is not quite so large, having the wing but eight inches and a half, and tail but six inches and a half, and it differs in having scarcely any trace of white above the tail, but only a narrow incomplete cross-band just above the coverts; there is also a very slight lateral margining of this colour to the feathers of the throat, and to the posterior ear-coverts; and the wings inside anteriorly, with the axillaries, are also white; the white of the belly being somewhat deeply tinged with fulvous. The present and our previous specimen are both from Bengal. A much injured skin from Tenasserim has considerably more white about the croup, thus further resembling the magnificent *P. Hodgsonii* and I make no doubt that the so called *Picus maximus Malayensis*, described by Dr. W. Bland in *J. A. S.* II. 952, refers to no other; the colouring exactly corresponds, if *fulvescent* be read for "yellow" on the belly and under wing-coverts; but the dimensions there assigned considerably exceed those of our specimens.

Gracula religiosa.

* *Vanga cristata*, Vieillot, badly figured in Griffith's Animal Kingdom, VI. 486.

Euplocomus erythropthalmos: female.

Captain Bonnevie being desirous of putting this Society in communication with the *Collegium Academicum* of Christiana, for the purpose of exchanging duplicates of Indian specimens for such as could be procured for us in the North-west of Europe, I have gladly assented to his request by sparing for that body certain duplicate Zoological specimens, for the most part procured in this immediate neighbourhood, and not required for the Museum of the Hon. Company in London; and I have also furnished him, at his kind request, for transmission to the Norwegian institution, with a list of such desiderata procurable in Northern Europe, as would enrich and add much to the interest of our own Museum.

From J. J. Athanass, Esq.,

Phœnicopterus ruber: a beautiful adult specimen of this Flamingo, forwarded alive from the Upper Provinces, and which reached us before life was quite extinct, and consequently in a favorable condition for being properly mounted, its plumage being uninjured, with the exception of the wings.

Also skins of

Gypaëtos barbatus, Storr; considered by Captain Hutton to be a distinct species—*G. Himalachanus*, *J. A. S.* III. 22, but which I agree with Mr. Hodgson (*Ibid.* IV. 458,) in inclining to regard as that found in Europe and North Africa, the more especially as among the drawings of the late Sir Alexander Burnes, I find one of a specimen devoid of the dark pectoral cross-band, which Captain Hutton presumes to be characteristic of the Lammergeyer of the Himalaya: a splendid adult.

Circætus undulatus.

From Dr. Pearson,

"*Accentor Himalayanus*" ? *; vide *J. A. S.*, *ante*, 187.

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* Distinct from two species of *Accentor* recently forwarded to the Society from Nepal by Mr. Hodgson.

From David Ross, Esq.,

An egg of the Cassowary *(Casuarius galeatus).*

From J. P. Hampton, Esq.,

Plotus Vaillaintii v. *melanogaster:* the Oriental Anhinga. A magnificent adult male, in finest possible condition of plumage. The anatomy of this bird I only very cursorily examined, from pressure of other occupation, and rather regret that I did not put the body aside in spirits; though I doubt not I shall soon obtain others, as I understand the Anhinga is not rare within a few miles of Calcutta. However, the general conformation of the soft parts was essentially that of the Cormorants, as might be anticipated; the capacious stomach possessed the accessory sac (analogous to that of the Crocodile) found in other *Totipalmati,* Cuv.; the intestines were long and furnished with the two small cœca usual in this group; and the sternal apparatus, which has been preserved, is absolutely similar to that of a Cormorant

From J. L. H. Gray, Esq. I have the pleasure to record the donation of skins of a very fine pair of

Argus giganteus, Tem.: male and female; and one of

**Phäeton* ———— ? or Tropic bird; species undetermined.

From Mr J. Keirnander,

**Aptenodytes Patachonicus:* Patagonian Penguin; the brightly coloured portion of the fore-neck and breast.

From —— Borradaile, Esq.,

Strix flammea: the common Barn Owl of Europe, which is of very frequent occurrence in Bengal: a living specimen, since dead and added to the Museum.

From E. B. Ryan, Esq., two living Hawks; viz.

Elanus melanopterus; and

Circus rufus: both mounted in the Museum.

From Lieut. Phayre, through Dr. McClelland,

Ardea purpurea: the common Purple Heron; a specimen from Arracan.

Among the Birds procured in the neighbourhood, or from the dealers, I may briefly notice—

Palæornis Alexandrinus, v. *nipalensis,* Hodgson, *As. Res.* XIX, 177: young male, purchased.

P. Malaccensis: ditto.

**Lorius ornatus,* Stephens: ditto.

**Falco tinnunculoides,* Tem.: adult female.

Circus rufus v. *æruginosus.*

C. Swainsonii, v. *pallidus.*

C. melanoleucos.

Cuculus fugax, Horsfield, v. *C. Lathami,* Gray: a good series.

C. canorus: the true British Cuckoo, which I have now living in a cage.

Phœnicura atrata.

* *Budytes citreola ?*

* *Coturnix textilis.*

Grus cinerea.

Parra Indica: adult and young, which latter totally wants the conspicuous white eye-streak of the adult, and is otherwise so different, that until I obtained a specimen in a state of change, I rather inclined to doubt their specifical identity.

Dendrocygna major, Jerdon.

Tadorna Bellonii* v. *vulpanser, Auct. the European Shieldrake, of which this is the second specimen I have met with in the bazaar; and lastly, I shall only further mention

Glareola torquata ; the Collared Pratincole : a specimen of which I had the good fortune to procure alive, leading me at a glance to perceive its true affinities, which heretofore had constantly puzzled me, in common, I believe, with every student of Zoology who has bestowed attention on the classification of Birds. Linnæus arranged this bird as *Hirundo pratincola ;* and Baron Cuvier included its genus among his *Echassiers* or "Stilt birds;" viz. the ***Grallatores***, or "Waders" of modern English systematists, remarking—"Nous terminerons ce tableau des échassiers par trois genres qu'il est difficile d'associer à d'autres, et que l'on peut considerer comme formant séparément de petites familles." The three genera adverted to are *Chionis*, ***Glareola***, and *Phœnicopterus ;* which are associated also by M. Temminck in his heterogeneous assemblage of odds and ends, styled by him *Alectorides.* Now, of these three genera, the first, or that of the Sheathbill *(Chionis)*, has been satisfactorily referred by M. Blainville, on anatomical data, to the immediate proximity of *Hæmatopus*, an association of which the propriety is readily seen when once suggested[*], and on similar data I have long been satisfied that the Flamingoes *(Phœnicopterus)* should be ranged among the *Lamellirostres* or *Anatidæ*, a position which has also been assigned to them by Mr. Swainson. This latter author, in common with most of the recent British writers on Ornithology, has referred the Pratincoles to the *Charadriadæ*, or Plover family, associating them more immediately with *Cursorius ;* but Mr. Jenyns (in his *British Vertebrata)*, really as if selecting the most *outré* position he could find, has included this genus in his *Rallidæ*[†]! There, too, Mr. Yarrell (in his 'British Birds') has followed him in grouping it; but this naturalist was so fortunate as to obtain an egg of our present species, which he has figured, and remarks that "the Pratincole has been arranged by some authors with the Swallows, by others near the Rails : but I believe, with Mr. Selby, that it ought to be included in the family of the Plovers; and had I known its Plover-like habits and eggs sooner, I should have arranged it between *Cursorius* and *Charadrius*." The figure of the egg which he has given, however, appears to me to accord still better with my view of the affinities of this genus. Several years ago, Mr. Gould called my attention to the fact that the Collared Pratincole had a slightly pectinated middle claw, and suggested to me whether, after all, the great Swedish naturalist was not right, at least in bringing this bird among the *Insessores Fissirostres* of Vigors; but at that time I inclined to hold a different opinion, and so far as the structure in question is concerned, that alone could scarcely influence the systematic position of the genus, as it occurs in widely separated families[‡]; and as I have further always held the opinion that the *Pressirostres* and *Longirostres* of Cuvier (corresponding to the *Charadriadæ* and *Scolopacidæ* of modern English systematists) composed but a single great series, essentially distinct from the *Cultrirostres*, Cuv. (*vel Gruidæ et Ardeadæ*), which the illustrious French zoologist interposed between the former, an analogous conformation was not wanting in that series, as instanced by the Black-tailed Godwit (*Limosa melanura*), while no trace of it occurs in the Bar-tailed Godwit (*L. fedoa*). Examining, however, the entire foot of a recent Pratincole, it will be seen that the resemblance it bears to that of *Caprimulgus* extends to the peculiar scutation, to the general form of the toes, and especially to the circumstance of the back-toe being directed inward; and whoever has witnessed the creeping gait of a British Moth-hunter (*Caprimulgus*) on the ground, will not fail to recognise in that of the Pratincole an exact similarity: moreover, many species of *Caprimulgus* have the tarse as much elongated as in *Glareola*, and I have been informed that certain of these assemble numerously on the mud flats near the shores of some of the West India Islands, where their habits would appear to resemble those stated of the Pratincoles. The mode of flight, too, of the latter is absolutely that of the Moth-hunters, and not by continuous flappings, as in all the *Charadriadæ*. But what first led me to perceive the affinity which this genus bears to *Caprimulgus*, was the expression of the physiognomy of the living bird, as I held it in my hand, and, to descend to particulars, the semi-tubulate form of its *nares*, and downward curvature of the short bill seen alike in both, though the latter is so much larger and stouter in *Glareola*; then, looking to the feet, the similitude was at least equally striking, while the form of the wings and tail, and mode of flight, were such as might be expected to occur in a diurnal modification of the family *Caprimulgidæ*, and together with the wide gape helped to remove this genus from the grallatorial order altogether. Even the egg, as figured by Mr. Yarrell, has not the pointed form at one end, characteristic of those of the Snipe and Plover series; but would appear to resemble nearly that of a *Caprimulgus*, in shape as well as in markings. On the other hand, the discrepancies of *Glareola* with any of the varied forms of nocturnal *Caprimulgidæ** are sufficiently obvious externally, while internally there are some very strongly marked differences; such as the configuration of the sternum, which is doubly emarginated posteriorly, and otherwise more approximates the form of this important portion of the skeleton of the *Charadriadæ*, while the tongue also is broad and flat, with a thin serrated tip, and the muscular coat of the stomach is considerably developed,—particulars at variance with the type of *Caprimulgidæ*, but which I only now briefly advert to, since I have not lately procured an example of the latter family with which to institute an anatomical comparison. Upon the whole, I have arrived at the opinion that the Pratincoles are more nearly related by affinity to *Caprimulgidæ* than to any other family in the class, but I hesitate as to whether they should be actually included therein, though, if so, I think that they should be regarded as at least constituting a very distinct sub-family, apart from the nocturnal genera, and thus I incline provisionally to arrange them.

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[*] Allied to *Chionis* are the remarkable genera *Attagis*, d'Orbigny, and *Tinochorus*, Vieillot, from the South American Cordilleras, and the anatomy of these equally refers them to the same systematic station. Vide Zoology of the Voyage of the Beagle under Captain Fitzroy.

[†] I need not ask what character it has in common with the Rails, but rather what it has not in direct and obvious opposition to them*!*

[‡] *E. g*, in many *Caprimulgidæ*, *Ardeadæ*, and *Pelicanidæ ;* its intent being apparently to cleanse the *rictus* from such fish-scales, &c as may adhere thereto, or, in the instance of the *Caprimulgidæ*, to detach the legs of beetles which may ditch and thus impede the bird's swallowing them

REPTILIA.

All that I have to notice, in this class, among the donations of the past month, consist of two specimens of *Testudo geometrica*, very young, which were packed with the other specimens received from Lieutenant Tickell; and a small banded *Gymnodactylus*, from Afghanistan, nearly allied to a species formerly transmitted to the Society by Lieutenant Tickell from Midnapore, and for which we are indebted to Dr. Thomson. This I shall characterize when I come to notice certain others of the Gecko tribe, which I am now trying to collect.

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* *Caprimulgus. Œgotheles, Podargus. Steatornis, Nyctibius.*

PISCES.

For the only specimen of a Fish, the Society is under obligation to Dr. Spry, who has presented us with a small recent example of *Zygæna laticeps*, Cantor, ('Quarterly Journal of the Calcutta Medical and Physical Society,' for July, 1837, p. 316, and beautifully figured at p. 318) it was taken in the Hooghly.

MOLLUSCA.

The interesting series of Chusan Shells presented by Dr. Cantor to the Society, have already been enumerated in his letter, and accordingly need only here to be thus briefly mentioned.

Those presented by M. M. Liautaud and Reymoneng, consist of the following species, of which such as are marked with an asterisk, bear the names with which those gentlemen have favored me: in determining some of the others, I have received the kind assistance of Dr. Cantor:—

From Toulon,
* *Natica castanea.*
* *Helix variabilis.*
* *Pupa cinerea* (Mink ?)
* —— *maculata.*
* *Cyclostoma maculatum.*
From Algiers,
* *Bulimus decollatus*, Draparnaud.
From Teneriffe,
Caracolla pyramidalis.
From Acupulco, Mexico,
Fissurella —— ?
From Panama,
Bulimus —— ?
From Guayaquil, Equatorial America,
* *Bulimus depuna*, Sowerby (?)
From Monte Video,
Planorbis —— ?
From Lima,
* *Physa Peruviana*, Sowerby.
From the Sandwich Islands,
Bulla fasciata, Lamarque.
From Bone Bay, Ascension Island (of the Carolines),
Bulimus —— ?
From the Phillipines,
Bulimus gracilis, Lea, *Trans. Am. Phil. Soc.* (n. s.), VII. 458, and pl. XL, fig. 6; being the third or white variety described by that naturalist; Luçonia.

Helix gigantea. Luçonia.

H. polychroa, Sowerby, *P. Z. S.*, 1841, 87, subgenus *Cochlogena*, de F.; *Bulimus virido-striatus*, Lea, *loc. cit.*, *ante*, p. 456, and pl. XI. fig 2.

H. luteo-fasciata, Lea, Ibid. p. 462, and pl. XII. fig. 13, but of a less flattened form than is there represented: Puerto Galera.

Cyclostoma Woodianum, Lea, Ibid. p. 465, and pl. XII. fig. 1.

Mytilus —— ? (Brackish water.)

From J. G. Heatley, Esq., I have the pleasure to acknowledge the presentation of a large and interesting collection of Shells, chiefly marine, procured from both the Asiatic and Australian shores of the Indian Ocean. The number of species comprised in this collection is far too great for me to attempt a catalogue of them on the present occasion.

INSECTA.

A valuable box of Insects, collected in Afghanistan, and especially interesting from the attention which has been alike bestowed on all the orders, has been presented to the Society by Dr. Thomson. The general character of these, I may briefly remark, and as may be supposed, is European, with an admixture of tropical forms, analogous to those found on the Himalaya. A variety of British species occur, and among the very few *Lepidoptera* sent, are included the extensively distributed *Cynthia cardui*, little *Polyommatus Alexis verus*, which the Society also possess from Kumaon, *Hipparchia Megæra*, of which also we have a Kumaon example, other species of this group—one common in the vicinity of Calcutta, and a handsome white-bordered species allied to *H. Semele*,—a *Thecla*, which appears to be the European *Bœtica* figured by Boisduval, *Thestia Pirene*, *Sphinx convolvulus*, the domestic *Bombyx mori*, and five or six other species undetermined. The number of *Hymenoptera*, *Coleoptera*, *Orthoptera*, and even *Diptera*, as well as *Hemiptera*, is considerable; but I cannot at present do more than notice them thus generally and briefly.

Again congratulating the Society upon the extraordinary number of donations with which it has been lately favored, indicative of the rapidly increasing interest taken in its Museum, and which, it may readily be conceived, has found me pretty ample employment in determining so many species as have been enumerated, not to mention various others, it now only remains to subscribe myself,

Sir,
Your most obedient Servant,
EDWARD BLYTH.

Accompanying plate Figs. 1, 2, 3, Skull of undescribed *Bos*, from the Keddah Coast, in the London United Service Museum (vide p. 447); 4, occipital view of Gaour's Skull; 5, Horns of the Banteng, or Wild Ox of Java (p. 446); 6, Head of *Cervus niger*, Blainville, from one of the late Dr. Buchanan Hamilton's drawings.—E. B.

Museum of Economic Geology.

Read the following report of the Superintendent of the Museum of Economic Geology on a specimen of Limestone, from Darjeeling, referred to the Museum by Lieut. BROOME, and his report on the Museum for April, 1842.

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3

H. Torrens, Esq.

Secretary, Asiatic Society.

Sir,—I have to report upon the specimen of limestone from Darjeeling referred to the Museum by Lieutenant Broome, that it is a very pure stalagmitic limestone, containing ninety-eight per cent. of pure carbonate of lime, the remainder consisting of traces of iron, minute portions of silex, and some animal and vegetable matter, to which its colour is owing.

2. On a large scale, the produce may be somewhat less if it is found that fragments of other rocks are imbedded in it, ours having one or two small fragments of common serpentine; but this will make but little difference in its value as a useful limestone.

3. As this is so very pure, and differs so much from the kunkurs in appearance, and by the absence of silex and iron, I have called it a stalagmitic limestone. If found in a cave, it is possible the original rock may not be far off, and that organic remains will be found beneath the floor of the cavern: both should be carefully searched for.

I am, Sir,
Your obedt. servt.
H. Piddington,
Superintendent, Museum Economic Geology.

Calcutta, 4th May, 1842.

Report of the Superintendent of the Museum of Economic Geology for the month of April.

Museum Economic Geology.—We have nothing to report here for the present month, it being useless to undertake any arrangement when we should have to break it up again in the approaching removal of our cases to the rooms downstairs which are to be appropriated to them, and these must first undergo considerable repairs.

I have drawn up a Circular, explaining in a popular style the beneficial objects of the institution, with its wants, which our Secretary has sent to the Press, and I hope it will be ready to be submitted at our next meeting

Geological and Mineralogical Departments.—We continue our arrangements here, and I am glad to report amongst them, that after a persevering search, the recovery of sixty-eight specimens out of seventy-seven, comprising the splendid and unique chronological series of Lavas from Vesuvius, from the Cabinet of the King of Naples, which was presented to the Society by our late President the Honorable Sir Edward Ryan. The catalogue of this series, with a translation, is in the hands of the Printers. In anticipation also of our now receiving Captain Herbert's catalogues from Mr. Batten, I have commenced arranging his series according to their numbers. I am also proceeding with the large Geological series mentioned in my last.

Museum Economic Geology.—The donations have been two bottles Sulphur water from the White Sulphur springs of Greenbriar County, Virginia, by the Agricultural Society.

A specimen of the best German Lithographic Stone, from Messrs. Ballin and Co.

Geological and Mineralogical.—A specimen of silicified wood from Van Diemen's Land; and

A stalagmitic ball from Chirra Poonjee, from F. Heatley, Esq.

H. Piddington,
Superintendent, Museum Economic Geology.

30th April, 1842.

For these Presentations and Contributions the thanks of the Society were accorded.

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JOURNAL

OF THE

ASIATIC SOCIETY.

A few Instructions for Insect Collectors.[*] *By* V. Tregear, Esq.

Entomological collections are now-a-days rather numerous in India, and would be more so, if the mode of preserving insects were generally known. There are many better qualified than myself to give instructions on the subject, but as the few directions I am able to give may be useful, I do not hesitate to offer them for the Journal. Independent of its scientific value, a well-preserved collection of insects is an object of attraction and interest to the most apathetic; the elegance and brilliancy of colouring, in some equalling the rainbow hues of the most beautiful birds; and the "shapeless" shape of others, in which they exceed, perhaps, the most fantastic formed monsters of the deep, with the wonderful variety of both colour and form, create those agreeable sensations of surprise and admiration, which constitute a large portion of the feeling called pleasure. Such a collection is not to be formed without trouble and attention, and if the necessary share of the former be bestowed on the first preparation and setting up, but little will be subsequently required. The great annoyances are damp and insects; the former is avoided by making the cases of dry wood, well varnished, or painting them in dry weather, and keeping them in a dry place; attacks of the latter are prevented by the application of arsenical soap, and having a quantity of camphor constantly in the cases; but this last is an expensive article as it readily evaporates, and some cheap and efficient substitute is a desideratum. The articles a collector must be supplied with are, pins, arsenical soap, a pair of fine pointed scissors, a lot of bristles from a large painting brush, a solution of lac in spirits of wine, a hand net, a collecting box, a drying box, and glazed preserving cases.

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[*] There is a paper "On the preservation of objects of Natural History," in the 4th vol. of the Journal of the Asiatic Society, by Dr. Pearson, an excellent authority on all such subjects.

The pins are made expressly for the purpose in England, France, and Germany, and are, there, very cheap; their sizes are various, from one inch and a half to three inches long, and of corresponding thicknesses; they are absolutely necessary, for the common pins are too short even for middling sized insects, and too coarse for smaller ones; another great advantage in the proper pins is, their allowing the insects to be kept at a distance from the bottom of the box, by which they are removed somewhat from damp, and placed out of reach of any insects which may breed in the lining.

Arsenical soap is easily made according to the recipe given in Dr. Pearson's paper. [Vide p. 478.] I have made it with native soap, which if of good quality, loses its offensive smell when mixed with the other ingredients.

The bristles are very useful for strengthening such insects as from slenderness would be liable to break, and for joining broken legs or antennæ; for the latter purpose a bristle dipped in the lac solution is inserted lengthwise into one of the pieces, leaving enough to go similarly into the other piece, the rest is cut off, and then the two joined together. For large insects a slip of bamboo peel is better, as being stronger, and in some cases cotton must be wrapped round it to give the size and shape of the body. I would generally advise the use of one or the other.

The lac solution is made by pouring on the pounded lac a quantity of strong spirits of wine, and placing it in the sun (close corked) till dissolved; it should be thick, and is useful in joining broken insects, and fastening on limbs.

The net is of gauze, eighteen inches long, and sewn on a wire or rattan ring one foot diameter, the handle of any convenient length.

The collecting box which I use is thirteen inches by eleven, and three inches deep, a pane of glass forming the front, and divided in two by a partition, which is again crossed by two others, making six divisions in all, each having a door one inch in diameter, closed by a disc of copper which swings on a small screw; each division opens behind also, to remove the contents, the door there being the whole size of the division. A box with many partitions is also very useful for sending to a distance, allowing each insect to be kept by itself, preventing their injuring each other, which they would do if many were jumbled together. It is a very bad plan to let the native collectors pin the insects as they catch them, for it is sure to be ill done, and moreover, as little pain as possible should be inflicted.*

Any box will do to dry the insects in, provided it excludes light and ants, the former having a very injurious effect on colours, particularly of Lepidoptera, which lose much of their brilliancy even from common daylight, and the cases containing them should therefore be kept covered. The form of cabinet is a matter of taste, but I think none will be found better than the one contrived by Dr. Pearson, for the Museum of the Asiatic Society. When open, it shews four perpendicular rows of boxes; of these two rows are in the body of the cabinet, and one row in each of the doors, the latter being made deep enough to receive them; when shut, the boxes in the doors face the others, and thus light and dust are excluded, and the contents of the whole exhibited at once when required. The individual cases may be of any convenient size; my own are twenty-two inches by sixteen and three quarters, and half an inch deeper than the longest pin; the top half fits into the bottom by a rebate three-quarters of an inch broad, and the box opens at about half its depth; the sides are five-eighths of an inch thick, and the bottom a quarter of an inch, the former well varnished, and the latter painted, inside and outside; if made in dry weather no injury is to be feared from damp. A single pane of glass is best on all accounts, and when let into the top, a slip of paper should be pasted over the edges of the box and glass, and a beading nailed or screwed on it. The bottom may be covered with cork, (which is good, but dear,) sola, or wax; the sola is prepared in sheets in Calcutta, and the paste used should always have some sulphate of copper dissolved in it; wax is excellent for the purpose, but (here) very dear. I have two boxes lined with it, and have not yet found any "uninvited" insects in them, while many have appeared in those with sola; the commonest wax is the best, as its strong smell may be in its favor, and it is cheapest. To line the box place it as level as possible, melt the wax, and pour it through a coarse cloth; it will, (if at a proper heat,) spread all over the box, which must be moved as required, if not quite horizontal: one-fourth of an inch is thickness sufficient, and all but large and heavy insects may safely be trusted in it, even with the boxes hung against the wall.

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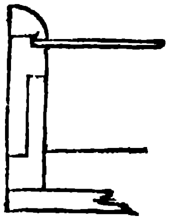
* A word or two on the "cruelty" of which Entomologists are accused. If by that word is meant "infliction of pain," I must plead guilty, but who are the accusers? Surely not you, my good Sir, who boast of the forty brace of snipe, or the fifty ditto quail have fallen before you. Nor you, my dear Madam, who, since this day last year, have delivered to the tender mercies of the cook, heaven only knows how many times 365 sheep, ducks, geese, fowls, &c. &c.—"Oh! but that was necessary"—Indeed! "we'll argue the point" some day, or if my accuser be of Wordsworth's "creed,"

That every flower
Enjoys the air it breathes;

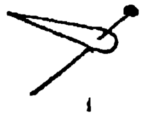
then are we equally guilty; for believe me, the fragrant rose which Chloe received with such a smile and blush—did, when you plucked it,

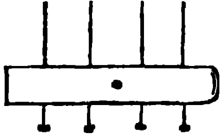
Feel a pang as great
As when a giant dies.

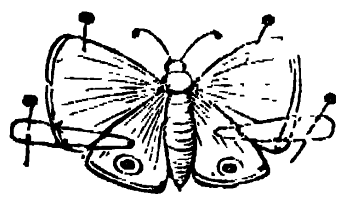


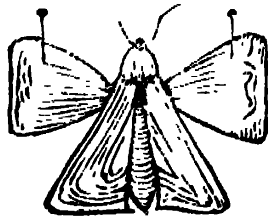
When an insect is caught, the first operation is to kill it, which, with all but Lepidoptera, may be performed by putting them in spirits of wine, or into a tin box placed in boiling water; large ones may be thrown at once into the water, which kills them instantly without injury, but this mode is for those only of strong make and dull colours, at least I have not ventured to adopt it with any but such. Butterflies and moths die on pressure of the thorax below the wings, taking care not to squeeze so hard as to burst it.

When dead they are to be cleaned, which in very many species is best done by raising the wing cases and wings, and removing the soft skin underneath; the whole of the entrails must be taken out, and the shell wiped with cotton; diluted arsenical soap is now to be applied with a camel hair brush, and some should be thrust into the thorax and head also if possible; close the wings and elytra, and through the right one insert a pin of fit size, bringing it out between the legs; about half an inch of the pin must be left above the insect for the convenience of holding it, and the whole length should be such as to keep the legs well clear of the bottom of the box, and allow a good hold in the lining. Those species in which the upper part of the body is exposed, must be opened below, either by a longitudinal cut, or removing a triangular piece; if the body be soft, the bristle or slip of bamboo put in it is to be wrapped with cotton to its size and shape, and the skin carefully placed over it; this is particularly necessary with the Orthoptera and Neuroptera, which, otherwise, lose very much of their natural appearance. The Coleoptera alone are pinned through the elytrum, all others through the middle of the thorax, and there are many of every order too minute to admit of being stuck either way. Dr. Pearson uses a strip of quill, one end being inserted between the rings of the abdomen, and through the other a pin is run; but as the quill is liable to curl and twist, I prefer using a bristle or fine pin, which is placed in a piece of cork, and by having the latter one inch long and quarter inch square, three or four small insects may be put side by side on one pin; a bottle cork will make several slips. The legs, wings, and antennæ, are to be placed in their natural position by pinning the insect to a loose piece of sola, brought conveniently near the body of the insect; the feet are fastened down by pins bent to a bayonet shape, or by slips of card pinned over them, which latter are also used to retain in a proper manner the wings of butterflies, &c. For Lepidoptera, the sola to which they are temporarily attached, should have a long hollow to receive the body, that the wings may lie quite flat; the upper pair in butterflies and some moths should be carried well forward to expose the whole of the lower ones, and may be held so by fine pins stuck through them. In those moths whose under wings are upper in repose, I would recommend that the former be drawn forwards, and the latter opened so much only as to shew the body, as in the following sketch; this method exhibits the natural form of the insect, as well as the under-wings, which are often very beautiful.









When the insect is pinned, and its limbs properly arranged, it is to be placed in the drying box till sufficiently rigid to allow of removal to the preserving cases. I do not advise sun-drying, as it often causes a shrivelled appearance, particularly with soft-bodied or delicate insects.

In the cabinet, they are to be kept as far from the lining as possible, and the feet should on no account be allowed to touch it.

Insects are sometimes preserved in spirits, but I have always found them liable to become mouldy when subsequently set up in boxes, which however may have been from the weakness of the spirits used; when the plan is adopted, I would advise their being cleaned out as elsewhere mentioned. Large insects with strong mandibles should not be put alive with others, as they will probably destroy their legs or antennæ.

Practice will suggest many minutiæ which I omit. The directions given will, I am certain, be found useful to those who wish to commence a collection, but do not know how; it is rather tedious work at first, but facility is soon acquired, and as the number of specimens increases, the labour is forgotten. A few boxes full have such a satisfactory appearance, that the pursuit will certainly be carried on with redoubled activity, and perhaps a taste for Natural History in general created, employing pleasantly time, which may otherwise pass but heavily.

Books on Entomology are expensive. I would recommend "Westwood's Text Book," as a cheap and useful work for a novice, and Boitard's "Manuel D'Entomologie," which is an excellent aid, as it gives a description of some thousand species, and contains an analytical table, by means of which the species to which any insect belongs, can be soon found.

Recipe for preparation of arsenical Soap.—As. S. Journ. Vol. iv. p. 462.

Take of Arsenic in powder, 2 lbs. White soap, 2 lbs. Salts of Tartar, 12 oz. Lime in powder, 4 oz. Camphor, 5 oz.

Cut the soap into thin slices, and melt it in a little water or spirit of wine over the fire; then add the salts of tartar and the lime. Take the mixture off the fire, and add the arsenic, taking care to mix it well by trituration in a mortar, or other convenient vessel; and when nearly cold, mix in the camphor, previously reduced to powder by the help of spirit of wine. When thus made, keep the arsenical soap in a glazed earthen pot, or a wide-mouthed bottle, and when used, dilute it with water to the consistence of cream.

The principal materials for both the above preparations may be procured in every bazar in India.

A Vocabulary of the Koonawur Languages.

ENGLISH.	MILCHAN.]	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Father,	Baba,	Apa, ou, agoo,	Apa, kea.
Mother,	Umma,	Umma,	Umma.
Husband,	Dach,	Daghpo,	Chogha.
Wife,	Nar, yas,	Moonee,	Yolat.
Son,	Chung,	Boocha,	P,huslee-chung.
Daughter,	Cheeme, cheemet,	Pomo, pama, choogoo,	Esree-chung.
Paternal Grandfather,	Tete,	Meme,	Meme.
Maternal ditto,	Boodooee,	Meme,	Meme.
Paternal Grandmother,	Tegow,	Apee,	Apee.
Maternal ditto,	Boodee,	Apee,	Apee.
Elder Brother,	Acho, ate,	Azho,	Acho.
Younger ditto,	Bya,	No,	Bya.
Elder Sister,	Apoo, reengs,	Azhee, nomo, tongmo,	Sheeng, sungmo.
Younger ditto,	Byach,	Namo, sungmo,	Bete.
Paternal Uncle,	Akoo,	Oogoo,	Akoo.
Maternal ditto,	Moma,	Ebee, azhung,	Azhung.
Paternal Aunt,	Nane,	Une,	Une.
Brother-in-law,	Shukpo,	Shukpo, mindokpo,	Shukpo,
Mankind,	Mee,	Mee,	Mee.
Man,	Mee, choungmee,	Mee, pooja, chokton,	Mee.
Woman,	Chishmee,	Pomo, moonee, chouree,	Eshree.
Child,	Chung,	Tooboo, pooza, toogoo,	Chung.
Relations,	Ate-bya,	Poola,	Acho-bete.
Male,	Skeo,	Agoo,	P,huslee, p,hoosree.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
Female,	Moonch,	Ane,	Mun.
Maneater, male,	Rakshush,	Teenbo, sheenpo,	Rakshush, shoona.
Ditto, female,	Rukshunee,	Sheenmo,	Rakshunee.
Ghost,	Khoongts,	Notpa,	K,hoong.
Ferryman,	Taroo,	Taroo,	Taroo.
Carpenter or mason,	Oris,	Shingso,	Oris.
Shoemaker or weaver,	Chamung,	P,heeba,	Chamung.
Blacksmith,	Domung,	Zo, gara,	Domung.
Goldsmith,	Sonarus,	Moolzo,	Sonarus.
Merchant,	Bora,	Chongpun,	Chongpun.
Shepherd,	Palis,	Loogzhee, dokpo,	Palis.
Bird-catcher,	T,hut,heal,		T,hut,heal.
Porter,	Chamung,	Sheebee, t,hee,ba,	Chamung.
Landholder,	Busin,	Misr, rukpo, dooa,	Busin.
Chief of a village,	Matus,	Lonbo, lasa, charus,	Matus.
A great man,	Damee,	Chidmo,	Shangnee.
Master,	Zeetus,	Noryotkun,	Zeetus, chookpo.
Servant,	Bando,	Labo, choonpa,	Lapa, choonpa.
Slave,	(None in Koonawur,)	Chuksis, goeul, yato,	
Trumpeter,	Hesee,	Bet,ha,	Kunalee, bajgee.
Trumpeter's wife,		Bemo,	
Drummer,	Ningarchee,		
Waiter,	Khidmutgar,	Zimoen, zimpon,	Khidmutgar.
Cook,	Botea,	Mazin,	Romdaree.
Vizier or wuzeer,	Bisht,	Kaloon, zongpoon, kalun,	Bisht, zompoon.
Interpreter,		T,hoongchee,	Katpa.
Doctor,	Hubba,	Hubba, larzhee,	Hubba.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Thief,	Chorus,	Skoonma, koodma,	Chorus.
Beggar,	Ooncheets,	Miltokh, rigin,	T,hoacheenee.
Enemy,	Shotrus, beeoor,	Madudpa, da,	Shotrus.
Coward,	Bamgeo, boco, bameo,		Bamgeo.
Friend,	Dost,	Gonshe,	Dost.
Liar,	Urkolis,	Zoondea,	Keakosa, kosk,hola,
Horse postman,	(None in Koonawur,)	Tazum,	
Monk,	Gelong,	Gelong,	Gelong.
Nun,	Chomo,	Chomo, anee,	Chomo.
Pilgrim,	K,hampa,	K,hampa,	K,hampa.
Head of a convent,	Gooroo,	Gooroo, lobun,	Lopon.
Scholar,	Lobtuk,	Lobtuk,	Lobtuk.
Inhabitant of the plains,	Neoolee,	T,hamee,	Neoolee.
Ram,	Ram,	Munee-pudma,	Ram.
Luchmun,	Luchmun,	Kesur-k,higoo,	Luchmun.
Seeta,	Seeta,	Choojoo-dooboo,	Seeta.
Kishun,	Kishun,	Eeshee-cheoorgeal,	Kishun.
Debee,	Debee,	Doolma,	Doolma.
Thakoor, of a temple,	T,hakoor,	Sangeas,	Sangeas.
Bhugwan,	P,ha,	Changra-zheekh,	P,hakpa.
Mahadeo,	Mahadeo,	Lopon,	Lopon.
Luchmee,	Zumala,	Zumala,	Zumala.
Lama,	Lamba, lumba,	Lamba,	Lamba.
Lamas with yellow caps,	Geloopa, gelookpa,	Geloopa, Deegooma,	Geloopa.
Ditto with red ditto,	Neengma,	Neengma, sakeea,	Neengma.
Ditto with red clothes,	Dookpa,	Dookpa,	Dookpa.
A God, (Deota,)	Shoo,	La,	La.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Animal,	Sheeo,		
Tiger,	T,har,	Ta, chan,	T,har.
Leopard,	Seek,	Zik, see, seek,	Sudur.
Bear,	Hom,	Barge, tong,	Hom.
Horse,	Rung,	Tah,	Shung.
Bull,	Dumus,	Langoong,	Langoong, etong.
Cow,	Lang,	Pa, Palang,	Balang.
Ram,	Kool,	Mamo,	Brang, ma.
Sheep,	Khus,	Loog,	Soom.
Ass,	P,hoch,	Poon, boomoo, bongo,	P,hoch, p,hot.
Mule,	Teeo,	Te, teeo,	Teeoo.
He-goat,	Aj,	Rabo,	Keoot.
She-goat,	Bukur,	Rama,	La.
Yak, male,	Yak, yag,	Yakh, yag,	Yag, yak.
Ditto, female,	Breemo,	Deemo,	Breemo.
Breed between Yak and Cow, [male,	Zo,	Zo, zobo,	Zofo.
Ditto ditto, female,	Zomo,	Zomo,	Zomo.
Deer,	P,ho,	Na,	P,ho.
Deer, with large horns,	Skeen,	Keeng, nean,	Keen.
Ditto, small ditto,	Sboo,	Joo,	Boo.
Ditto, of another kind,	Kakrus,	Baral,	Tanmo.
Wild Goat,	Sar,		War, namo.
Musk Deer,	Roch,	Ropache, laba,	Rots.
Hog,	Soorus, soongur, chest,	Toorfa, phak,	Soongur.
Ditto, wild,		Reep,ha,	Reep,ha.
Dog,	Kooee,	K,hee,	Khooee.
Cat,	Peeshee,	Peela, pooshee,	Peeshee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Monkey, large,	Gohnus,	Teeo,	Gohnus.
Ditto, small,	Bundrus,	Sheeo,	Bundrus.
Sheep and Goats,	Zilung,	Choogma,	Chooma.
Mare,	Gonma,	Golma,	Gonma,
Colt,	Rung kachookts,	T,hooroo,	Shung kachook.
Young Ass,	P,ho kachookts,	Boomtoog,	P,hot kachook.
Wild Yak,	Dong,	Dong,	Dong.
Ditto Horse,	Keang,	Keang,	Keang.
Ditto Ass,	Goork hur,	Goork hur,	Goork,hur.
Pup,	..	K,heegoo,	K,hooeekchung.
Kid,	..	Loogoo,	Kulat.
Monkey's Cub,	..	Teegoo,	..
Calf, male,	..	Peto,	Zochur.
Ditto, female,	..	Peto,	Moondlo.
Flock of Sheep,	..	Loogrung,	Lamashala.
Hare,	Reehong,	Reehong,	Reehong.
Rat,	Peeoo,	Peea,	Peeoo, peeo.
Mouse,			
Fish,	Muchus,	Neea,	Muchus.
Snake,	Sabas,	Dool,	Brool.
Frog,	Tipluk,	Balba,	Tipluk.
Porcupine,	Shaee,	Toodoom,	Shur.
Centipede,	Zhachus,	Shunglaboo,	Shunglaboo, rangrabeoo.
Lizard,	Chemur,	..	Chunkla.
Grasshopper,	Sblen,	..	..
Locust,	Shelus,	..	Sherus.
Caterpillar, or maggot,	Hong,	Boo,	Boo.

English.	Milchan.	B,hoteeá or Tartar.	T,heburskud.
Fly,	Yung,	Dung,	Boeung.
Bee,	Wus yung,	D,hangoong,	Pranchee-beeang.
Firefly,		Mesokboo,	Mesungboo.
Bug,	Sootee,		Sootee.
Spider,	Bootux,		Daee-boeung.
Moth,	Lach,		
Flea,	Spoog, ..	Cheeshee,	Meetee.
Butterfly,	Shoopeach,	Chabla,..	Shoopeach.
Musquito,	Chachee,	Koeung,	Koeung.
Louse,	Reek,	Sheek,	Shee.
Bird,	Pea,	Cha,	Pea.
Fowl,	Kookree,		Kookree.
Hawk,	Pazee, ..	T,ha,	Pazee.
Pigeon,	Rapeea,	Mookoo, moogrun,	K,hurin.
Chukor,	Teek, tig,	Takpa,	K,hure.
Crow,	Kak,	Kakse, karo, garok, p,horok,	Ka, p,horok.
Kite,	Goldus,	T,hangar,	Goldus.
Goose,	Arus, koorul,	Nangba, moorba, choopcha, reegechamo,	Nangba.
Swan,	..	Toongtoong,	
Duck,	Geeltung,	Geeltung,	
Peacock,	Morus,	Mebja, mapcha,	Mabja.
Head,	Bul,	Go, ta,	Peesha.
Crown of head,	Moling,	Tukchur,	Geatoor.
Face,	Sto,	Gontong,	Mamee.
Forehead,	Pheea,	Tawa, tana,	P,heea.
Hair,	Kra,	Sha, g,ho,	Kra.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Lock of hair,	Uzroo,		Roogchul.
Throat,	Gulung,	Ole,	Shango, golung.
Tongue,	Le,	Che,	Le.
Tooth,	Gar, bung,	So, k,ha, sokh,	Soa.
Neck,	Kakts, rakso,	Midba, okche, kemik,	Kaklee.
Mouth,	K,hagung,	K,ha,	A.
Beard,	Dar,hee,	Geow, k,hapoo, k,heeboo,	Darhee.
Mustachio,	Wusung, moocha,	K,hoopa,	Wasung, moocha.
Lips,	Toonung,	Makub, shooto,	Toonung.
Nose,	Stagoos,	Na,	Neoom.
Eye,	Meek,	Meek, doogmee,	Mee.
Ear,	Kanung,	Amchok, namgeo,	Rupung.
Eyelid,	Meekchung,	Meekpoo,	Meekchung.
Chin,	Chetkung,	Male,	Okeo.
Arm, hand,	Got, god, good,	Lakpa, lakpeego, lak,	La.
Right hand,	Zugun-got,	Lakpa-lafa,	Zuhung-la.
Left ditto,	Derung-got,	Lakpa-yonma,	Derung-la.
Elbow,	Krooch,	Teemojon,	Keeototo.
Fist,	Moot,ho, goochoo,	Mooltookh,	Moot,hoo.
Finger, toe,	Prach,	Zoogoo, tante,	Brang.
Nail of finger,	Cheen,	Sidmoo,	Shen.
Shoulder,	Rank,hal,	Poongpa,	Poongpa.
Foot,	Bung,	K,hungba, t,hebo,	Bungk,hut.
Small of leg,	Peelung,	Geetpa,	Peelung.
Thigh,	Loom,	Lasea.	Boolung.
Knee,	Poosh-pung,	Peemo, poohmoo,	Pooshpung.
Palm of hand,	Hustulung,	Lukt,hil,	Lukt,hil.

English.	Milchan.	B,hoteeâ or Tartar.	T,heburskud.
Eyelash,	Meekchung, mikhrong,	Mekhp,ho, menma,	Meekchung, mikhrong.
Rump,	Chongto,	Chongto,	Chongto.
Heel,	T,hongul,	Tinge, tingba,	T,hongul.
Waist,	Re, guchung, ko,	Kedpa,	Kedpa.
Skin,	Sha,	Pakhpa,	Pakhpa.
Joint,	Sanig,	Ching,	Chikh.
Breast,	Stook, stoo,	Tang, ning,	Keoo.
Belly,	Peting,	Todpa, p,hopa, topa,	K,hok, k,ho.
Back,	Pooshting,	Geap,	Geab.
Bladder,	Koopee,	Koopee, kopee,	Koopee.
Vein,	Seerung,	Sah,	Seerung.
Fat,	Chus, meez,	Cheeloo,	Cho.
Bone,	Harung,	Ropa, rooba,	Harung.
Marrow,	Goot,	Kang,	Kang.
Eyebrow,	Meekcham,	Meekcham,	Meekcham.
Blood,	Pulach,	T,hak,	Shooee.
Breath,	Dako,	T,hungchache,	Dako.
Thumb,	Motus-prach,	T,hebo, t,hedmoche,	Prach.
Hole of ear,	Kansooling,	Nughab,	Kanikee.
Pupil of eye,	Meeksil,	Pootlee,	Meekzoor.
Nostril,	Staksooling,	Nakoong,	Neoomedoeng.
Cheek,	Peeng,	Zingba, damba,	Dampa.
Armpit,	K,heeteeks,	Chingloung,	Keetlee.
Sole of foot,	Potlung,	Kangdil, kangba,	Kangt,hil.
Small of arm,	K,heoots,	Langura,	La.
Hair of body,	Spoo,	Poo,	Poo.
Pudendum viris,		Lebe, kotoh,	

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Pudendum mulieris,		To,	
Navel	Naeeng,	Teeba, teea,	Teba.
Ankle,	Pukat,	Longmora, cho,	Pukat.
Hollow below knee,	Koangcheek,	Keengra,	Pooshpang, yoogin.
Urine,	Chin, chibee,	Chin, chibee,	
Body,	Deung,	Zoog, zookpo,	Zoospung.
Liver,	Sheen,	Chinba,	Chinba.
Heart,	Steeng,	Loa, sim,	Loa, shesha, sim.
Testicle,		Lokhpa, lokpa,	
Gums,	Steel, neel,	Gil, neel,	Neél.
Cue, worn by Chinese,	Ralpa,	Takchur,	Takchur.
Woman's breasts,	Peepee, yeboo,	Numa, yeboo,	Peepee.
Upper part of arm,	K,heooch,	Poomo,	Keoot.
Wing,	Pukrung,	Shokpa,	Shokpa.
Egg,	Lee, leech,	Ghoa,	Toom.
Tail,	Poornung,	Gama,	Mekon.
Cobweb,	Zool,		Torung.
Cock's-crest,	Moling,	Takchur,	Geatur.
Feather,	Pool,	Pool, shookpa,	Pool.
Bird's-beak,	Shonung,	Chootoo, chooto.	Shonung.
Nipple,	Pood, peechoo,	Aeebo, noma,	Peechoo.
Cow's or Deer's horns,	Root,	Racho,	Roocho, reecho.
Sweat,	Doostee,	Chadpo, dooshtee,	Rabung, doostee.
Sleep,	Neendrung,	Neet,	Eef.
Swelling,	Pooch, purung,	Zerba,	Pooch.
Goitre,	Gunung,	Bah,	Gunoo.
Hunger,	On,	Togree,	Khebung.

English.	Milchan.	B,hoteeá or Tartar.	T,heburskud.
Thirst,	Cheesh,	Koomree,	Teekurbung.
Wound,	Mooheets, p,hoor,	Shooa,	Ke.
Famine,	Unkalung,	Unkalung,	Unkalung,
Pain,	Chot,ho, todo, doshung,	Nacha, doongal,	Nabung, took,hung.
Pleasure,	Khoshee,	Dakin,	Khooshee.
Smell,	Ganum,	Deema, t,hema,	Deema.
Sneezing,		Reedba,	
Kiss,		Pookh,	
Spittle,	Tookung,	Cheema,	Kratee.
Love,		K,hunta,	
Flavour,		Khamee,	
Cough,	Choo,	Loodpa,	Gool.
Cubit,	Reen,	T,hoo,	Kroo.
Smoke,	Doomung, doobung,	Tootpa, doodpa,	K,hoo.
Stink,		K,hachucks, deema-ganba,	Deema-kochung.
Life,	Zeewa,	Tok,	Zeeoo.
Truth,	Suchelee, deemung, nirbaning,	Dangpo,	Deemlo.
Theft,	K,hoocheo, choramung,	Kooa,	K,hootka.
Cold,	Lisk,	Tangmo,	K,hatkeo.
Heat,	Tapung, zhang,	Mede, dodmo, d,hoonma, donmo,	Kotra, donmo.
Fever,	Bok,	Rim,	Bok.
Justice,	Suchumee,	Tangpo,	Sucho.
Lie,	Urkolung,	Zoond,	Keko.
Knot,	Toonga,	Dootok, changdoo,	Toonga.
Merchandise,	Chong,	Chong,	Chong.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Baggage,	Lotpot,	Nor, chilak-pulukh,	Lotpot.
The Plains,	Neeul,	T,ha, geaghur,	Neeul.
Debt,	Reen,	Booloon, pooling,	Toa.
Security for a person,	Logonis,	Nemee,	Logonis.
Charm,	Stoongma,	Shooan,	Toonga.
Ascent,	Ring, tang,	Yer, kean, gen, yala,	Tang, lo.
Descent,	Shoong, zhup,	T,hoor,	T,hoor, yat.
Amusement,	Tumasha,	Tanmo,	Tanmo.
Abuse,	Galing,	Munmo,	Galing.
Age,	Deem,		
Boundary,	Seemung,	Sungsum,	Seemung.
Top,	Beel,	K,hato, k,hatook,	K,hacheoot.
Bottom,	Po,	Yok,	Po.
Battle,	Rashim, dashim,	T,hanmo, t,hookpa,	Mublo, breeshbung.
Complaint,	Poosheem,	T,himtook,	Poosheem.
Country,	Bonung,	Rear, loongba,	Bonung.
Crack,	Rookts,	Chakpo,	Reesha.
Defeat,	P,hamcheeo,	Shoorne,	P,hamung.
Fear,	Beang,	Zheeg,	Gearbung.
Handful,	Sgar boong,	Baragung,	Roaring.
Hill,	Rung, runga,	La,	Yooe.
Loud noise,	Dumskatwado,	Ka-chinmo,	
Delay,	T,hara,	T,hagring,	
Middle,	Muzhung,	Zhoong,	Keelo.
Noise,	Shad,	Ka,	Lutung.
Name,	Namung,	M,heen,	Meen.
Peak,	Groocho,		

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
Plain,	Soldus,	T,hunga,	T,hunga.
Road,	Om,	Lam,	Om, am.
Rust,	K,hyung,	Ya,	K,hoeeung.
Range,	D,hanee,		
Song,	Geetang,	Loo,	Gerib, greb.
Bundle,	Books,	Bokcha,	Book, shateen,
Fold,	Doon,	Bak,	Ba.
Time,	Karung, detra,	Lal, lan, chot,	Karung,
Ashes,	Buspa,	T,hawa, koktul,	Miling,-bating.
Hole,	Doeeng,	Meegung, meeoong,	Doeeng.
Service,	Dang, chakree,	Yokpa, makh,	Lapa.
Order,	Hookum,	Ka,	Hookum,
Precipice,	Donk,hung,		Donk,hung.
Trap,	Lurkee,		
Medicine,	Shel,	Mun,	Mun.
Cast,	Zat,	Rikh,	Zat.
Small Hill,	Danee,	Gongo, gankha,	
Shadow,	Soot,	Teema, deep,	Silib.
Spark,	Keeang,	Mechak,	Keeang.
Step,	Goumpa,	Gompa,	Gompa.
Thing,	Bust,	Nor, zok,	Chongzo, bus.
Business,	Kamung,	Lakha, laha,	Len.
Word,	Batung,	Kacha, tam, kat,	Kamchee.
Place,	Pra, pusrung, zaga,	Te, nasa dusa, dungsa,	Polung, jat,ho.
Victory,	Gyleeo, zeetecho,	Gealpa,	Gealbung.
Language,	Buzum,	Doonma,	Buzum.
Something,	Chood, chut, t,hooch,	Chang, mana,	Khulee, k,hakashe, k,hao.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Mortar,	..	Zing, shing,	
Price,	Molung,	Gong, rin, reeng,	Molung.
Dream,	..	Meengmun,	
Custom,	Put,hung,	Lookh, t,heem,	Put,hung.
Hour, (about 20 minutes,)	Gurung,	Choosut,	Gurung.
Colour,	Rung,	Marchoo,	Rung.
Light of Fire,	Deebung,	Milche, marme,	Deewung.
Wick of Lamp,	B,hatee,	Dooksur, dongsur,	Dongsur.
Brink,	Beel,	Dul,	Dam.
Mud,	Kaluk, lus, yarung,	Dumbuk,	Kaluk.
Rock,	Rooning,	P,hulong,	T,hol.
Stone,	Rug, rak,	Doa,	Ra.
Pebble,	Rak,	Tochoong, changpo-doa,	Rak.
Slate,	Pan,	Pan,	Pan.
Sand,	Balung,	Teeoo,	Balung.
Seed,	Beeung,	Toogmin, songun,	Peezud, sangun.
Burden,	Barung,	K,hooroo,	K,hooroo.
Field,	Reem,	Zheeng,	Ree, reem.
Corner,	Zir,	Doo,	Zoor.
Wall, side,	Beet,	Cheekpa,	Beeting.
Sun,	Yoone, yoonek,	Neema,	Nee.
Moon,	Gulsung,	Dagar,	Gulsung.
Star,	Skara,	Karma,	Karma.
Moon-light,	Gulsung-chagis,	...	
Thunder,	Goorgooree,	Took, dook, doong,	Goorgooree.
Lightning,	Bizhoong, bijil,	Longmal, loghmur,	Bizhoong.
Earthquake,	Boonchooling,	Sangool,	Sangool.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
Eclipse,	Gronung,	Zanjeen,	Gronung, rowa.
Rainbow,	Teerameets,	Zheazun, sheen,	Moorung-moortee.
Cloud,	Zhoo,	Teen,	Zhoo, deengma.
Wind,	Lan,	Langda, hoor,	Lan.
Fire,	Me,	Me,	Me.
Air,	Hash,	..	
Earth,	Matung, sho,	Sakea, sa, sucha,	Matung.
Sky,	Surgung,	Nam,	Nam.
Ice,	Shanung,	Golchuks,	Shanung.
Frost,	Pagrum, pugle,	Keakh,	Shanutpung.
Hail,	Shoroo,	Shoree,	Shoroo.
Snow,	Pum, pung, pom,	K,ha,	Ung.
Rain,	Rodung, doeung,	Chirba,	Rodung, mookpa.
Spring,	Renum,	Peetka,	Gendo, goondo.
Winter,	Goon,	Dang-medokh, goonga,	K,hutkeo.
Autumn,	Charmee,	Tonga,	Sheldo.
Rainy season,	Shul,	Yarka, tonga,	Sheldo.
North,	T,hoad, reeng, delung,	Zhung,	Zhung.
South,	Shoong, jak,hung,	Zampooling,	Zampooling.
East,	Nes,	P,hala, shur,	Dooroo, shur.
West,	Ning,	P,hurka, nook,	Doozoor, nook.
North-west,	..	..	Leengchoong.
Village,	Deshung,	Yool,	Deshung.
House,	Keem, keoom,	K,hangba, seekoong,	Keoong, keoom.
Cow-house,	K,hoorung,	Loogra,	Bong.
Cottage,	Shundung,	Reezhing,	Shurnung.
District,	K,hoodung,	K,hoodung,	K,hoodung.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Subdivision of a District,	Goree,	Chookhso,	Guree.
Fort,	Gorung,	K,hur,	Gorung.
Board,	Ro, p,hur,	Pangle,	Chuplung.
Post, Pillar,	T,hungung, t,hungmung,	Ka,	Tukh.
Ladder,	Cham,	Sanga,	Sanga.
Arch,	Togung,	Rupsul,	Teenul.
Beam,	D,harung, borning,	T,hogee-doongma,	Bororing.
Rafter,	Zhuldarung,	Daloo, duloo,	Zhuldarung.
Door,	Dwaring, beetang,	Go, seekpa,	Peetung.
Window,	Boning,	Karkum,	Boneet.
Door-post,	Cheekree,	Ribjee,	Ribjee.
Chain for fastening door,	Hoorung,	Golduk,	Golda.
Hook for ditto ditto,	Chootz,	K,hoozoor, geeling,	K,hooroor.
Shop,	Hatee,	T,hom,	Hatee.
Flat Roof,	Moolt,hung,	K,hadik,	Cham, kheam.
Sloping ditto,	Chuprung,	Tang, t,hok,	Chuprung.
Temple,	Kot,hee,	P,hobrung,	Kot,hee, kutarung, Choring.
Flag,	Darchut,	Durche, durboche,	Durchut.
Garden,	Sharung,	Mendok-doomra,	Sharung.
Hedge,	Chir,		Chir.
Dyke,	During, d,huno,	Cheekpa,	During.
Upright posts for grapes,	Stoong,		Toong, tukh.
Arbour for ditto,	Bashung,		Bashung,
Year,	Bursung,	Lo,	Bursung.
Month,	Gol,	Daba, dawa,	La,
Day,	Dear, laee,	Neema zam, shakpo, za,	Dear, zhangma.

ENGLISH.	MILCHAN.	B,HOTEEA* OR TARTAR.	T,HEBURSKUD.
		Zugh, zhangma,	
Next Year,	Hedmia bursung,	Nungbur,	Orche.
Last ditto,	Noling bursung,	Nuning,	Noning.
This ditto,	Toling bursung,	Dalo,	T,honing.
Noon,	Adung-laee,	Neema-p,he,	Neer.
Midnight,	Adung-rating,	Chan-p,he,	Adung-rating.
Night,	Rating,	Chanmo, chan, gongmo,	Moondo, moonea.
Sunrise,	Zila,	Neema-shur,	Neezhoorpung.
Sunset,	Reda,	Neema-kea,	Neegeootpung.
Morning,	Somsee, sum, sangodoo,	Gnara,	Numutre.
Evening,	Toora, toorung, shoopa, shoobux,	Gokhmo, chan,	Namberbung.
To-day,	Toro, trole,	Tering-neemo,	Diring.
Yesterday,	Me,	Dan, dang,	Yangto.
Day before Yesterday,	Ree,	K,hiringsha,	Dookeang.
To-morrow,	Nusum,	Namo, nangmo,	Aeero, yoor, gnyro.
Day after to-morrow,	Romee,	Nam, nang,	Meengeea.
Long Day,	Shul,	Neema-ringbo,	Shildodear-shung.
Short ditto,	Goon,	Neema toogoon,	Cheegeet-dear.
Water,	Tee,	Choo,	Choo.
River,	Sumudrung,	Sangpo, muksung, khampa, sanpoo,	Sumudrung, sampoo.
Rivulet,	Garung,	Dokpo, loongba, tokpo,	Noongpa.
Well with stone spout,	Baee,	Chooling,	Baee.
Ditto with wooden ditto,	Choo,	Chooling, tarche,	Choc, wa.
Ditto for washing clothes,	Goot,hoo,	T,homa,	Yoor, goona.
Pond,	Kooung,	Zing,	Cho.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Lake,	Cho,	Cho,	Cho.
Canal,	Koolung,	Yooba, yoora,	Yoor.
Strong Current,	Teelee,	Choang, shookh,	Shookh.
Skin for crossing rivers,	Mushkee,	Kelpa,	Kelpa.
Drop,	Choktee,	Soora, t,hikpa,	Choktee, chokchee.
Fog,	Dooeeng,	Mokhpa,	Mokhpa, mokpa.
Small Drops,	Oshung,		Zilba.
Wooden Bridge,	Tsam,	Samba, zum,	Zampa.
Rope,	Turung,	Took, suzum,	Twarung.
Tree,	Botung,	Tam, shingnokh, pang, shingdong, tongpo,	Botung.
Bush,		Dongpo,	Sul.
Forest,	Bunung, kunarung,	Rega,	Bonung.
Bark,	But, bur,	Konpa,	K,holub.
Branch,	Yulga,	Yulga,	Yulga.
Leaf,	Putlung, putrung,	Lep, laptee, loma,	Putlung.
Root,	Zhilung,	Pudugh,	Zhilung.
Wood,	Sheeng,	Sheeng,	Sheeng.
Pine,	Kelmung, ryung, leem,	Geam,	Geam.
Pine, *Neora*,	Ree, shungtee,	Kuminche, koneeunche,	Ree, reet.
Birch,	Shak,	Shakpan, toghar, takpa,	Shooput, shukh.
Oak,	Broo, bure,		
Poplar,	Lam, lanba, langba,	Langba,	Mughul.
Large Juniper,	Shoor,	Shookpa,	Shookoo, shoorpa.
Creeping,	T,hiloo, bidelgung,	P,huloo, pama,	Pama.
Another sort,		Bettir,	
Gooseberry,	Neange,		Neange.

English.	Milchan.	B,hoteea' or Tartar.	T,heburskud.
Bamboo,	Kokuk,	Neooma,	Koka.
Reed,	Damboo,	Neoogoo,	Pee.
Thistle, Thorn,	Cho, koolchoo,	Chirma,	Choa.
Flower,	Oo,	Metok,	Mento.
Fern,	Sdoo,		
Hemp,	Kas,		Bungero.
Cotton,	Kapa,	Rapal,	Kapa.
Grass,	Chee,	Sa,	Chee.
Straw,	Boosung,	P,hooma,	Boogoo.
Fruit,	Sho,	Dulboo,	Oosho.
Apple,	Pale, palek,	Kooshoo,	Kooshoo, tahung.
Apricot,	Chool, choolee,	Choolee, boorzha,	Choolee, boorzha.
Pear, large,	Bisrus,		
Ditto, small,	Leech,		Leet.
Peach, large,	Adogung, kutearo,		
Ditto, small,	Rek, bemee,		Rok.
Grape, Raisin,	Dak,hung, dahung,	Goon, goondoom,	Goon.
Walnut,	Ka,	Tarka,	Kat.
Horse Chesnut,	K,hunour, poo,	Poo,	Poo.
Lime,	Sah,	Sah,	
Stone of Apricot,	Remoo,	Rakche,	Remo.
Grain,	Choa,	Jukhpe,	Broo.
Wheat,	Zud, jot, zot,	Do,	Rozud.
Panicum Tartaricum,	Bras,	Tao,	Brao.
Ditto Emarginatum,	Ulgo,	Geamda, geamk,heer,	Keamre.
Amaranthus Anardhana,	Dankur,	Beet,hoo,	Chilaee.
Paspalum Scrobiculatum,	Kodro,	Koto,	Kota, kotro.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Hordeum Cœleste,	Ooa, ooe,	Neeoo,	Tingzud.
Barley,	Tuk, soom, ta,	Soa,	Zut.
Pease,	Pytung,	Tunma, t,hulma,	Pytung.
Beans,	Chustun,		
Rice,	Ral,	Da,	Rul.
Flour,	Cheesang,		
Flour of Wheat,	K,hunukung,	Pukhfe,	K,hunukung.
Parched Grain,	Yoot,	P,he, sumba,	Yooeet.
Cucumber,	Kookree,		
Turnips,	Shagur,	Neoongma, yoongma.	Shagur.
Greens,	Skand, skan,	Chunma,	Kan.
Red Pepper,	Peeplee,	Soorpunsa,	Peeplee.
Ginger,	Shont,	Chega,	Chega.
Opium,	P,heemee,	K,hercha,	P,heemee.
Onions,	Chong, peeaz,	Chong,	Chong.
Garlick,	Lostung,	Gokhpa,	Lafoo.
Wild Garlick,	Goze,	Koche,	Cheeskun.
Meat,	T,hoopa,	Sha,	Sha.
Food,	Zamek, zamo,	T,haktok,	Zabung.
Sugar, fine,	Shakrung,	Kara,	Shakrung.
Sugar, coarse,	Gooram,	Gooram,	Gooram.
Butter,	Mar,	Mar,	Mar.
Milk,	K,heerung, b,herung,	Oma,	Pel.
Butter-milk,	Bot, rat,	Tara,	Dara, botee.
Curdled ditto,	Doeung,	Sho,	Pil, keasp,hel.
Bread,	Bot,	Tigir, takree,	Tagree, rot.
Honey,	Wus,	D,hang, tangsee,	Pranchee.

ENGLISH.	MILCHAN.	B,HOTEA OR TARTAR.	T,HEBURSKUD.
Tea,	Boj, cha,	Cha,	Cha.
Intoxicating Spirits,	Rak,h,	Arak,	Rak,h.
Wine,	Shoo,	Chang-chamo,	Shoodung, yoo.
Tobacco,	Tumakoo, gurak,hoo,	Tumak, tumang,	Tumakoo, gurak,hoo.
Snuff,	Nusar,	Natik,	Nusar.
Salt,	Tsa,	Tsa,	Tsa.
Saltpetre,	Zunsao, shora,	Shora,	Shora.
Sulphur,	Gunik,	Moozhe,	Moozee.
Zedoary,	Nirbees,	Ponga,	Nirbees.
Oil,	Telung,	Markoo,	Mat,hee.
Bees' Wax,	Seetung,	Tasing, tasil,	Seetung.
Turpentine,	Ch,hee,		Ch,hee.
Musk,	Katrung,	Larzee, lerzee,	Katrung.
Ditto, pod of,	Beena, bena,	Ladoom,	Bena.
Glue,	Silesh,	Peen,	Peen.
Poison,	Beeshung,	Dook, tok,	Beeshung.
Cap,	Tepung, tobung,	Shao, shamo, teebee,	Tepung.
Turban,	Pag,	T,hot,	Pak.
Shoe of Blanket,	Spon,	Lam,	Bulzhum, balzun.
Ditto of Leather,	Poolre, kooshera,	Koosheeree, kufsha,	P,honee.
Caps worn by Chinese,		Menchook, b,hoorko,	
Large Blanket,	Doree,	Zan, zango,	Doree.
Small ditto,	Chadur, yanglees,	Neanglook, neangnoos,	Neangnoos.
Garment of Blanket,	Chooga,	Chooga,	Chooba.
Ditto of Sheepskin,	Porin,	Lakpa,	Lakpa, laga.
Ditto of Goat's-hair,	K,heear, k,hercha,	K,heear,	K,heear.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Trowsers,	Sootun,	Nameea, kangnum, toorma,	Sootun.
Gloves,	Goozub,	Lakshoop,	Goozub.
Any kind of Garment,	Unga,	Koh,	Gola.
Stocking part of Boot,	P,heenpa,	Pingpa,	Peengpa.
Garters,	Bongre,	Lamdokh,	Lamdokh.
Boots,	Uluk,	Lam,	Lam.
Stockings,	Tingbol,	Tingbol,	Tingbol.
Clothes,	Gas,	Doghluk, goluk,	Goluk, goloo, gola.
String for Trowsers,	Choorkoo,	Rugboo,	Sirko.
Girdle, Waistbelt,	Gachang,	Kerakh. kera,	Puret.
Pocket,	K,heesa,	Chanda,	K,heesa.
Carpet,		Gat,hao,	
Handkerchief,	Loongee,	Loongee, t,halong,	Loongee.
Felt,	Numda, p,heenpa,	Numda, cheengpa,	P,heengpa, numda.
Cloth,	Kupra,	Ra,	Ra.
Clasp for Gown,	Peechook,	Peechoo,	Peechook.
Earrings,	Duretoo, gukloo, moorkee,	Sogong, konta,	Sogong, kokhroo.
Beads,	P,hrea,	Motpukun,	P,hrema.
China Silk,	Geanjee, goshen,	Geanjee, magoshin.	Geanjee, tankama, doogreema, k,hurlona.
Cowrie Shells,	Kooreets,	Roonboo,	Geoen, gentz.
Ring,	Moodee, kaonr,	Soortook,	Laksub.
Bracelets, Anklets,	Daglo,	Doogoo,	Daklo.
Wool,	Chum,	Pul, bul,	Cham, chum.
Ditto of Sheep,	Beang-chum,	Chung-bul,	Beang-chum.
Worsted,	Ra.	Kootpa, nalma,	Bee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Rope,	T,hakpa,	T,hakpa,	T,hakpa.
Shawl Wool with hair,	Lana,	Lena,	Lena.
Ditto without ditto,	K,hulchukhs,	K,hulchukh,	Kulchukh.
Hair among Shawl Wool,	Robung,	Ral,	Ral.
Yak's Hair,	K,holoo,	Sedpa,	Sedpa.
Goat's ditto,	Robung,	Ral,	Ral, robung.
Twine,	Shagro, reet,	Rakoot,	Ree.
Thread,	Bat,	Doongsur,	Bat.
Tent of Cloth,	Tumboa,	Koor, goor,	Tumboa.
Ditto of Yak's hair blanket,	Tumboa,	Rebo,	Rebo.
Cow's leather,	Tulung,	Koa,	Tal, pok.
Goat's ditto,	K,hool,	K,hool,	K,hool, pukhpa.
Saddle,	Shga,	Ga, ka,	Ga.
Bridle,	Shtap,	Shap,	Tap.
Stirrup,	Yopchun,	Pop, yop,	Yopchun, yopchen.
Umbrella,	Chutrung,	Seera, seeleea,	Seeleea, chutrung.
Walking Stick,	Choongma,	D,hekpa, pirka, geookpa,	Choonga.
Whitewash,	Cheet,	Karchee,	Gooroo.
Charcoal,	T,ho,	Shola,	Sola.
Mica,	Chiklim,		
Convent for Monks,	K,hatg,honpa,	G,honpa, goomba,	G,honpa.
Back-basket,	Koting, keeda,	Konba,	Kotee.
Convent for Nuns,	Chomoling,	Chomoling,	Chomoling.
Small Table,	Chokse,	Chokse,	Chokse.
Picture,	Lareeks,	Labreek,	Labreek.
Sticks for giving light,	Sang,	Mezhogh,	Mesung.
Cart,	Gadee,	Sheta-k,holo,	Gadee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Palanquin,	Palkee,	P,hepchang, geokchang,	Palkee.
Fire-place,	Meling,	T,hap,	Meling.
Spindle for twisting Worsted,	Koroo,	K,heeree,	P,hang.
Handmill,	Gotung,	Rantak, randa,	Got,hung.
Watermill,	Tee-gotung,	Chootakh,	Tee-got,hung.
Lid,	Peedung,	Gum,	Gum.
Pole of Tent,	T,hungung,	Goolkeookh,	Birk,ha.
Wooden Pin,	Poorts,	P,hoorba,	P,hoorba.
Lamp,	Deebung,	Chonme,	Deebung.
Looking Glass,	Ashoo,	Melong,	Chokee, ashoo.
Comb,	Kungt,hung,	Soa,	Shoir.
Stone Mortar,	Kaning,	Doltok, koolmo,	Koolmo.
Pair of Scales,	Pore,	Pore, neagha,	Pore.
Trap,	Lurkee,		
Ball,	Butlas,	Reelbo,	Potokh.
Bag,	P,hut, t,holee,	P,hut,	P,hut.
Foot of Table,	B,hung,	Kangba,	B,hung.
Skin for Flour,	K,hool,	K,hoolche, kealba,	K.hool,
Spectacles,	Pistow,	Migra,	Migra.
Granary of Wood,	Oorch,		Sheengmung.
Box,	Dobee,	Gamchoong,	Gamchoong.
Ditto for Papers,	Koteech,	Eegum,	Grom, eegum.
Cross-bow,	Goon,		
Trunk,	Kot,	Zuma, gum,	Gum.
Bed,	Manzo,	Manzo,	Manzo.
Glass,	Sheeshee,	Shel,	Sheeshee.
Pellet-bow,	Shungum,	Dankong,	Shankong.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Pellet,	Shung,	Dochoong,	Shungra.
Hooka,	Chilum, hooka, jajree,	Hooka,	Hooka.
Chillum,	T,hotee,	Top,	T,hotee.
Surposh,	Boodnee,	K,hachot,	Chilum, k,hop.
Hooka Snake,	Nalo,	Nalee,	Nalee.
Smoking Pipe,	Gungsa,	Gungsa, k,hungsa,	Gangcha.
Sea Shells,		Daba, neema,	
Rupee,	Roopeea,	Mool,	Roopeea.
1 Ditto,	Eet roopea,	Mool-see, mool-cheek,	Tee-roopeea.
2 Ditto,	Neesh roopea,	Mool-nee,	Neshee roopea.
3 Ditto,	Soom roopea,	Mool-soom,	Soom roopee.
½ Ditto,	Delee,	Tangsa, tanka,	Delee.
Penny,	Dubwa,	Dubwa,	Dubwa.
Halfpenny,	Dela,		Dela.
2 to 4 Annas silver coin,	Tumasha, paolee,	Zhow, geow,	Timashee, paolee.
Book,	Pot,hee,	Lukpum, potee,	Chogee-potee.
Letter,	Eegee, kuglee, kagulee,	Eegee, eezookh,	Eege, akhrung, kuglee.
Paper,	Kukalpat,	Shoogoo,	Therik, shoogoo.
Pen,	Nookdo,	Denyon, dingeo, deoon,	Neookshing,
Ink,	Seeahee,	Naksa, sirl,	Naksa.
Inkstand,	Mushajun,	Nakoong,	Nakoong, nushajun.
Written Paper,	Eezhe,	Eezhe,	Eezhe.
Religious Character,	Oochen,	Oochen, lunra,	Oochen, lunra.
Letter,	Oome,	Oome,	Oome.
Pots of all kinds,	Baring,	Nooshet, nooshut,	Baning.
Cooking Pot,	Butloee,	Dig,	Butloee.
China Saucer,	Derma.	Derma,	Derma.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
China Cup,	Kareeul,	Kareeul,	Kareeul.
Earthen Pot,	K.hoang, gur,	K,hangse, t,hooa,	T,hooa, k,hoang, lotung.
Wooden Vessel, large,	Zum,	Zum, darozo, soomjok,	Zum, zom.
Wooden Vessel with spout,	Jooa,	Soa,	Zoa,
Brass Pot, large,	Lotree,	Digchoong, loogoo,	Lotree,
Ditto Plate,	Nang,	Derma,	Nung.
Small brass Pot,	Bat,	Prat,	Prat.
Wooden Plate, for kneading flour,	Koonalee,		Koonalee.
Camp Basket,	Pit,har,	Zima,	T,habdom.
Teapot,	Tibril,	Batib,	Tibril.
Teaspoon,	Chidoom,	Chidoom,	
Spoon,	K,heoch,	Chakcho, t,hoorma,	K,heot.
Iron for baking Bread,	Pan, ronpun,	Pan,	Rompun.
Iron Tripod, for Pot,	Lodanung,	Cheegeat,	Lodanung.
Wooden Vessel, small,	P,horwa,	P,horwa,	P,horwa, prot.
Benares,	Kasee,	Ooranasee,	Ooranasee.
Jugurnath,	Chamchookdoong,	Chamchookdoong,	Chamchookdoong.
Gya,	Durjeedin,	Durjeedin	Durjeedin.
The Ganges,	Chooma-gunga,	Choomo-gunga,	Choomo-gunga.
Mine,	K,haning,	Koomchang,	K,haning.
Ore,	Daeeung.		
Gold,	Zung,	Ser,	Zung.
Silver,	Mil, mool,	Mool,	Mool.
Iron,	Rung, run, pron,	Chakhs, chukh,	Chakh.
Copper,	Tramung,	Sang, zango,	Trumung.
Tin, Pewter,	Sot,	Sankurbuso,	Sot.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
Brass,	Peetul,	Raghan,	Peetul.
Mercury,	Mulchoo,	Mulchoo,	Mulchoo.
Lead,	Seek,	Shanee, riltee,	Seek.
Borax,	Ch,hale,	Ch,hale,	Ch,hale.
Gun, large,	Ramchung, top,	Toorka,	Top.
Ditto, small,	Topuk,	Toorka,	Topuk.
Matchlock,	Nal,	Doobuk, tooba,	Nal.
Bayonet, Spear,	Burcho,	Doong,	Burcho.
Shield,	Dal,	P,hoop,	D,hal.
Sabre,	Trooal,	Raldee, barung,	Trooal.
Scabbard,	Shoob,	Shoop,	Shoop.
Leaden Ball,	Galung,	Reeldee,	Galung.
Bow, crooked,	Goom, kuman,	Zhoo,	Goom, kuman.
Ditto, straight,			Yooee.
Arrow,	Mo	T,ha, da,	Sheem.
Gunpowder,	Daroo,	Za, man,	Daroo.
Knife,	Koor, koorch, k,hoorch,	Tee,	K,hoor.
Axe, for killing animals,	Goonaso,	Limba,	Goonasoo.
Ditto, for cutting wood,	Lashta, Dangra, tubur,	Turee, taree,	Lakt,ha.
Penknife,	Bankeech,	Neoogdee,	Neoogdee.
Razor,	K,hoorunts,	T,haguree,	Shagree, k,hoorung.
Needle,	Kep,	T,hak,hub, k,hab,	Kep.
Iron Chain,	Sumlung, suglung,	Chaktak,	Sunglung.
Steel, for striking fire,	Ronk,ho,	Mepcha, mekcha,	Mepcha.
Bell,	Gangt,hung,	Dheeloo,	Gantung.
Key,	Talung,	Koolig, d,heming,	Deemee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Padlock,	Shanung,	Koolchakh, golcha,	Zhona.
Hoe,	Zam,		
Plough,	Stul, hulung,	T,hong,	Halas.
Yoke of Plough,	Shkol,	Neasing,	Pol.
Chissel,	Neano,	Zong,	Zong.
Pair of Tongs,	Cheemtoo,	Krampa,	Krampa.
Ditto of Scissors,	Katoo,	Katikpa, chemzhe,	Zhabre, chinba.
Saw,	Retur,	Sogle,	Retur.
Mallet,	Sdo,	Do,	Do.
Drill,	Burm,	Burm,	Burm.
Adze,	Basing,	Tebo,	Keoot.
Large Hammer,	Gonto,	T,hoa,	T,hoa.
Small ditto,	T,horo,	Lakt,ho,	T,horo, t,hochoong.
Anvil,	Gonung,		
File,	Sekdur,	Sekdur,	Sekdur,
Borer,	Meeoong,	Meeoong,	Meeoong,
Blowpipe,	P,hookree,		P,hookree,
Iron Crow	Mokung,	Chakber,	Mokung,
Ditto Wedge,	Chenung,		Mat,
Ditto Nail,	Keelung,	Zer,	Keelung,
3 Pinchers,	Soneshung,		Shoneshung,
x Pricker,	Shulung,	Shulung,	Shulung,
Nippers,	Chups,		
Bellows,	Sak,hool,	Boota, bootpa,	Bhootpa,
Pickaxe,	Goling,	Tokche,	Khoat,
Small Drum,	Dulkeech,		Dulkee,
Large Trumpet,	Kunal,	Poa,	Kunal,

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Small Trumpet,	Shonal,	Hurib,	Shonal,
Fiddle,	Dutaro,	Gobo, peang,	Peang, gobo, dutaree,
Kettledrum,	Dhol,	Gna,	Dol,
Tambourine,	Ningaro,	Damun,	Domak,
Fife,	Basung,	Neoo, leoon, leengo,	Basung,
Sea Conch,	Doong,	Doong, toong,	Doong,
1	Eet,	Cheek,	Tee.
2	Neesh,	Nee,	Neeshee.
3	Soom,	Soom,	Soom.
4	Poo, pook,	Zhee,	Pee.
5	Gna, ma,	Gna,	Gnaee.
6	Took, toog,	Took,	Tookee.
7	Steesh,	Doon,	Nushee.
8	Raee,	Geat, gea, ge,	Geaee.
9	Sgoee,	Goo,	Gooee.
10	Saee,	Choo-t,hamba,	Chooee.
11	Seehud,	Chooksheek, chookshee,	Chootee.
12	Soneesh,	Choonnee,	Choonee.
13	Sorum,	Chooksoom,	Chooksoom.
14	Supoo, supookh,	Choobzhee,	Chupee.
15	Suma, songa, sunga,	Choonga, chynga,	Choang.
16	Surk, sorok, sotok,	Chootook, choorook,	Chooroo.
17	Suteesh,	Choobdeoon, choobdoon,	Choobdoon.
18	Surhaee,	Chubgead, chubge,	Chubgead.
19	Susgoee,	Choorgoo,	Choorgoo.
20	Neeza,	Neeshoo,-t,hamba,	Nisa, neeza.
21	Neeza-eet,	Chaksheek, chakshee,	Neeza-tee, &c.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
22	Neeza-neesh, &c.	Channee,	
23		Chaksoom,	
24		Chabzhee,	
25		Changa,	
26		Charok, chatok,	
27		Chabdoon,	
28		Chabgead, chabge,	
29		Chargoo,	
30	Deo-neeza,	Soomchoo-t,hamba,	Deoneeza.
31	Deo-neeza-eet, &c.	Soksheek, sokchee,	Deoneera-tee, &c.
32		Sonnee,	
33		Soksoom,	
34		Sobzhee,	
35		Songa, synga,	
36		Sorok, sotok,	
37		Sobdoon,	
38		Sobgead, sobge,	
39		Sorgoo, sorkoo, soorkoo,	
40	Nee-neeza, neesh-neeza,	Zheebchoo-t,hamba,	Neesh-neeza.
41		Shaksheek, shakshee,	
42		Shannee, zhynee,	
43		Shaksoom, zhyksoom,	
44		Shabzhee, zhybzhee, &c.	
45		Shunga, shanga,	
46		Sharok, shetok,	
47		Shabdoon,	
48		Shabgead, shabge,	

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
49		Shargoo, sharkoo,	
50	Dyneeza,	Gnabchoo-t,hamba,	Dyneeza.
51		Gnaksheek, gnakchee,	
52		Gnannee,	
53		Gnaksoom,	
54		Gnabzhee,	
55		Gnunga,	
56		Gnarok, gnatok,	
57		Gnabdoon,	
58		Gnabgead, gnabge,	
59		Gnargoo, gnarkoo,	
60	Soom-neeza,	Tookchoo-t,hamba,	Soom-neeza.
61		Raksheek, rakchee,	
62		Rannee,	
63		Raksoom,	
64		Rabzhee,	
65		Ranga,	
66		Rarok, ratook,	
67		Rabdoon,	
68		Rabgead, rabge,	
69		Rargoo, rarkoo,	
70	Sadeshum-neeza,	Doonchoo-t,hamba,	Soom-neeza-chooee.
71		Tonsheek, donchee,	
72		Tonnee, donnee,	
73		Tonsoom, donsoom, &c.	
74		Tonzhee,	
75		Tonga,	

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
76		Tondook,	
77		Tondoom,	
78		Tongead, tonge,	
79		Tongoo,	
80	Poo-neeza,	Geatchoo, geazhoo-t,hamba,	Pinneeza.
81		Keasheek, geachee,	
82		Keannee, geannee, &c.	
83		Keaksoom,	
84		Keabzhee,	
85		Keanga,	
86		Keorok, keatok, geto,	
87		Keabdoon,	
88		Keabgead, keabge,	
89		Keargoo,	
90	Pooneeza-saee,	Goobchoo-t,hamba,	Pinneeza-chooee.
91		Koksheek, kokchee,	
92		Konnee,	
93		Koksoom,	
94		Kobzhee,	
95		Konga,	
96		Korok, kotok,	
97		Kobdoon,	
98		Kobgead, kobge,	
99		Korgoo,	
100	Ra,	Gea-t,hamba,	Gea.
200	Nee-za,	Neebgea,	Neeshee-gea,
300	Soom-ra,	Soomgea,	Soom-gea,

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
400,	Poo-ra,	Zheebgea,	Pee-gea.
1,000,	Huzar,	Tong,	Choo-gea.
100,000,	Lak,h,	T,hee,	Lak,h.
10,000,000,	Kuror,	Boom,	Kuror.
1st,		Tangbo, dajee, goma,	Doonchee.
2d,		Nip,ha, neeba,	
3d,		Soomba,	
4th,		Zheeba,	
¼,	Prebung,	Cheekcha,	Pure.
½,	Adung,	Phe,	K,hanung.
¾,	Soompre, shoompre,	Soomcha,	Soompure.
1½,	Deo,	Cheek-p,he,	Deo.
2½,	Dy,	Neesh-p,he,	Dy.
Twofold,	Neesh-doon,	Neebak,	Neeshba.
Threefold,	Soom-doon,	Soombak,	Soomba.
Once,	Eet-karung,	Lalcheek, lalcheeg,	Teekarung.
Twice,	Neesh-karung,	Lannee,	Neeshkarung.
January,	Mahang,	Daba-chooneeba,	Mahang.
February,	P,hungnung,	Daba-d,hangba, tangbo,	P,hungnung.
March,	Chetrung,	Daba-neeba,	Chetrung.
April,	Bysagung,	Daba-soomba,	Bysagung.
May,	Zhestung,	Daba-zheeba,	Zhestung.
June,	Asharung,	Daba-maba, gnaba,	Asharung.
July,	Shamnung,	Daba-tookpa,	Shamnung.
August,	Badrung,	Daba-doonba,	Badrung.
September,	Indurmung,	Daba-ketpa, keba,	Indurmung.
October,	Kateeung,	Daba-gooba,	Kateeung.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
November,	Mooskeerung,	Daba-chooba,	Mooskeerung.
December,	Poshang,	Daba-chookcheekpa,	Poshang.
Sunday,	Aeetwarung,	Za-meema,	Aeetwarung.
Monday,	Soarung,	Za-daba,	Soarung.
Tuesday,	Munglarung,	Za-meengmar,	Munglarung.
Wednesday,	Bood,harung,	Za-lakpa,	Bood,harung.
Thursday,	Brasput,	Za-p,hoorboo,	Brasput.
Friday,	Shookarung,	Za-pasung,	Sookarung.
Saturday,	Shunsheerus,	Za-penba,	Shunsheerus.
I,	Goo, goos, neenga,	Gna,	Gee, geo.
Thou,	Kee, ka, kas,	Keot, ogo, k,herung,	Hoonee, gnan, gna.
He,	No, nos, zha, zho,	P,haee, te, k,hong,	Oodoomee, uroo, wa, p,ha.
We,	Kishung,	Gnatumshe, net,	Eneshe, eneatung.
You,	Kee, kees, keena,	Kherung-tamshe, k,hetgeak,	Gnaneeshe, oonpatung.
They,	No, nogonda, zohugo,	P,hagee-tamshe, wateshe,	Urteeshe.
This,	Yo, zha,	Dee, d,hee,	Oea, aee, yooee.
That,	No, noo,	Ote, oode, p,hagee,	Oza, uroo, ado.
You all,		Keozhuk, keozha, goon,	Goon.
We all,		Gnazhuk, net,	
Who,	Hatto, haee,	K,hoee, soola, soo, kangeeda, sooee,	Soonee, soo. K,hainde, go, k,ha, ka.
What,	T,he, hum,	Chee, gang, ka, cha,	Gee.
Mine,	Ung,	Gnarung, gnaringee,	Gnan, oonee.
Yours,	Kana, keena,	K,heourung, keoringee, keoke,	Uroo.
His,	Zhoo, noo,	Te, no,	
Any body,		Lering,	
One's own,		K,hoee,	

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Whatever,		Zhalma, shalma,	
Another,	Aee,	Zhancheek,	Drongtee.
How many,	Te, tera,	Champeen, chumgee, chum,	Eneta, wanee, ene.
All you people,	Che-kee,	K,heot-tamchat,	Hoonatung.
This side,	Zhoom, zhang,	Choorka,	Deezhoor.
That side, across,	Noom, nung, noong,	P,harka,	Doozhoor.
Near, beside,	Nerung,	Doroo, nemoo,	Nemo.
Beyond,	Nip,ha, nipa,	P,hagee, p,hala,	Dooroo.
Away,	Nes, nis,		
Without (wanting,)		Mitkun,	Manunee.
Again,	Neepee, he, nepeks,	Pheemo-chookpa, dalda,	Neooa, tatla, logh, dulda.
Yes,	An, a,	Ou, la, koosul,	Ou, oung, o.
No,	Maee, manee,	Me, met,	Manee.
Pleasantly,	Dambeeraee,	Tanbo,	Tanmo.
Whence,	Humche,	Kana,	Gochee.
What like,	Hales,	Cheenda,	K,hunea.
How often,	Tenjubur, te,	Cham, chamcha,	Enekta.
That place,		Tere,	
From within,	Komo,	Tangma, nangma,	Nongonche.
Above, Up,	T,hoa, t,hook, den,	Tang, nang, k,hatok,	T,harung, chokcho, chopcho,
Below, Down,	Yooa, yoog,	Yokh, yog, mala,	Yogoon, yoogoon, yoogin.
Afterwards, Backwards, Behind,	Neooms,	K,habrul, geatpo,	Geabchee.
Before,	Ooms,	Koongtal, doondo,	Donchee.
Between,	Manzhong, muzhung,	Zhoong,	Keelo.
Enough,	No, up,har,	Yong, mangbo,	Ho.
Here,	Zhooa, toa, yooa, lo,	Deeroo, eeroo,	Oeea.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
There,	Noa, doa,	P,hagee, magee,	Doa, ona, oza.
Hence,	Zhoouks,	Deena, gana,	Oeachee, aeeche.
How, How much,	Tera, te, teta,	Chum, chumcha,	Ene, enekta.
Now,	Hoon, hoona,	Ta, takhsung,	Lisungo.
Quickly,	Hal, hasil, hojoa,	Shok, jokhfa, geokpa,	Keookhpa, geokpa.
When,	Terung,	Nam, name,	Eno, eenoo.
Slowly,	Mesung,	Kale, goloo,	Mesung.
Within,	Koomo,	Nangdoo, tangdoo, tangna,	Nangdoo, nowun.
Without,	Barung,	P,ha, p,heeta,	P,heetala, p,heelokh.
Where,	Hum,	Kangdoo, gana, ga, gan, kala,	Goa, go.
Very,	Dir, up,har,	Mangbo,	Bong.
Always,	Suda,	Tandoo,	Soda.
From,	Buksh, duks, na, no, che,o	So, na, soo,	Che, un, chee, soo.
With,	Dung, rung,	Laroo,	Dung.
In, into,	O,	Roo, la, doo,	Un, oon, goon, che.
On, upon,	En, o, den, oon, oom,	La, k,hatookba, le,	To, chapcho.
More,	Aee,	Diring, yang,	Duroong.
At another time,	Nepeks,	Zhanla, logh, dalda,	K,heenping, neka.
Also,		Lang,	Lee.
Any where,	Kamee, hamee,	Ganeung, goeo,	Goeo.
Of,	O,	Ge,	Ge, ke.
To, For,	O, lo, ung, rung, pung,	La, roo,	O. do, to, goon, un, na.
Why,	Chera, phoo,	Cheela, cheephila,	K,hyro.
Or,	Kee,		La.
White,	T,hog,	Karbo,	T,hungnee, chungnee. chang.
Black,	Reg, rok,	Nakpo, nangmo,	Kanee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Red, Red hot,	Shooeeg,	Marbo,	Mangnee.
Green,	Rag,	Zhango,	Zhango.
Blue,	Rak, rok,	Monpo,	Teengnee.
Yellow,	Peek, peekla,	Surbo,	Lene.
Light-grey,		G.honpo, toosee,	
Brown,		Keata, zheangnak,	Zheankoo.
Orange,		Chinka, chulkur,	
Striped,		T,hata, t,hao,	Patlo.
Square,	Poozrak,	Doobzhee,	Peezoor.
Round,	Boorboor,	Riril,	Boorboor.
Oval,	Lamas,	Nurnur,	Chonchon.
4-sided,	Poozir,	Doobzhee,	Peezoor.
5-sided,	Gnazir,	Doongna,	Gnazoor.
Even, Plain,	Pudrus, sped, mushtus,	T,hangbo, dunda,	T,hanga, t,hanea.
Different,	Soso, hednee,	Soso,	K,hecho.
Same,	Eedee,	Neampo,	Neampo.
Clean,	Mahtus, t,hog,	Karbo, takpo,	Chungnee.
Dirty,	Kree,	Tema,	Kree.
Dark,	Aeearung, aeenarus, tam-sang,	Moonteekh,	K,habung.
Light,	Zhudodoo,	T,hungpo,	Chunglung.
Dear,	Gotee, zatee,	Gonbo,	P,hampo.
Cheap,	Churus, bodee,	K,hemo,	K,he.
Dry,	Charch, chars,	Kampo,	P,horka.
Wet,	Teesre, speeng, speesh,	Lonpa,	Cheeko.
Distant,	Warik, dur,	Ringbo, t,hagring,	Warkor, war, warko.
Near,	Nerung,	Nemo,	Nemo.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
Fresh,	Kanung,	Nurgamo,	Ma-soashea.
Rotten,	Sanung, soasho,	Nurmet,	Soashea.
Fat,	Motus,	Bompo, rompo,	Burka.
Lean,	Nakeech,	T,hamo,	Nakeet.
Fine,	Lanus, paech,	T,hamo, tapo,	Nakeet.
Coarse,	Motus,	Rombo,	Burka.
Good, Well.	Dam, dambash,	Gamo, poochung, etpo, kamo, jakpo,	Ebuta, epo.
Large,	Tek, teg,	Chinmo, chitpo, chidmo,	Shangnee.
Small,	Gato, zaich, zigich,	Choogoon,	Tsigee, keta, zigit.
Large and Small,		Chuchoong,	
High,	T,hoa,	T,hampo,	T,hampo.
Low,	Yooa,	Mamo,	Mamo.
Finished,	Doogeo,	Yongsong,	Wangzoo.
Heavy,	Leehig,	Cheende,	Leeko.
Light,	Langeets,	Yangmo,	Yanko.
Hard,	Talk,	Geongbo,	Geongbo.
Soft,	Kolus,	Boolbo,	Boolbo.
Hot,	Zhang, zhabung,	Donmo,	Kosra.
Cold,	Lisk, leesk,	Tangmo,	K,hutkeo.
Much, many,	Churus, teong, up,har,	Sambo, mangbo,	Bong.
Few,	Cherib,	Choogoon,	Zigit,
Narrow,	Zatee,	Zhenchoogoon,	Zhenchoong.
Broad, wide,	Churus, koonk,	Zhenchinmo,	Zheengchun.
New,	Neoong,	Soma,	Neoongnee.
Old,	Ooshk, roozha,	Neengpa,	Neengpa.
Naked,	Salgee	Chergong,	Suptee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Well, Whole,	Sarus,	Changbo,	Sarus.
Sick,	Sursheemurko, truch, toto,	Nazha,	Nabung.
Right,	Zugung,	Yatal,	Doore.
Left,	Derung,	Yoontal,	Bae.
Deaf and Dumb,	Lata, zharo,	Kol,	Lata, kol.
Weak,	Murdar,	Romyookung,	Lonatpa.
Strong,	Moostund,	Shakageakhpa,	Moostundo.
Perpendicular, Plain, Strait,	Pudrus,	T,hungpo,	T,hunea.
Slanting,	K,her,	Yonte,	K,her.
Uneven,	Yooa-t,hoa,	Gen-t,hoor,	Tang-t,hoor.
Crooked,	K,hoongsheem, koota, kootang,	Goorgoor,	Goorgoor.
Blind,	Kanung,	Zhura,	Kano.
Lame,	K,horus, k,horung,	Zhao,	Khorus.
Lazy,	T,hisk,	Lelo,	Ulseekh.
Clever,	Dambash,	Gamo,	Epobash.
Some,	Cheta,	Cheeachee,	K,hulukha.
Deep,	Doogus,	Syting, chokheeldoo,	Doogus.
Written,		Teechur, deeaeeut,	Chegunee.
Right,	Tateek,	Teek,	Tan.
Full,	Boongee,	Kangchur, k,hang,	Bingzo, bingo.
Empty,	Shaee, shagee,	Toongba,	Toongpa, tongpa.
True,	Sochus,	Dinba,	Deemlo.
Rich,	Zeetus,	Nurduk,	Chookpo.
Poor,	Daljees,	Meltokh,	Metpo.
Ripe,	Shoeeo, loongeo,	Choghain, choa,	Shobung, sho.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Unripe,	Mashos, mashoeo, cheeshpoeo,	Meechoghain.	Kachung, masho.
Young,	Dekrus, dikrach, neook,	Shura, soma,	Shura.
Beautiful,	Dam,	Lakpo,	Zoko.
Ugly,	Maree, kochung,	Chookpo, t,hoo,	Mazoko.
Bad, Wicked,	Mur, kochung,	T,hamu, lodpa, dibchun, aghe, ganba, chookpo,	Kochungta.
Sour,	Soork,	Keoormo,	Soorko.
Sweet,	T,heek, im,	Zimba, shimbo, gnarmo,	Neamko.
Bitter,	Kahuk,	Shantee, k,hakpo,	K,huktukpa.
Silent,	Tam,	Tame,	Tamna.
Slack,	T,hisk,	Yangpo,	Moktus.
Tight,	Chal,	Tokpo,	Gutus.
All,	Choee, she,	Top, t.hamche, t.hamchat,	U,ung, shet.
Angry,	Roshung,	T,hoogro,	Cheekpa.
Blunt,	Mootlo,	Me-nunpo,	Me-chunko.
Sharp,	Rask,	Nunpo, numpo,	Chunko.
Broken,	Zhookeo,	Chokchur,	Keakcha, keaka.
Running (Water,)	Beho,	Loonga,	
Cloudy,	T,hinga,	T,hinga,	Dinga.
To Ask, Beg,	Oonming, eemig,	Rezha, dheeja, ribja,	T,habung, t,hoabung, shao-pung.
„ Arrive,	Poonmig, pooshmig,	Gerzha, langzha, lebzha,	Nookpung, nootpung.
„ Assemble,	Doomig,	Chungma-dozha,	Autung-zapung.
„ Ascend,	Tangmig,	Gen-lerja,	Tungmung.
„ Allow,		Chookcha,	Matpung.
„ Be,		Yozha,	
„ Buy,	Zongmig,	Neozha,	Chongbung.

ENGLISH.	MILCHAN.	B,HOTEEA' OR TARTAR.	T,HEBURSKUD.
To Burn, *v. a.*	Pongmig, bongmig, beenmig,	Tookzha, takzha,	Rotbung, beekpung.
„ Blow,	P,hoongamig, p,hokramig,	P,hoozha,	P,hoobung, p,hoosootpung.
„ Beat (a Drum,)	Tongmig, bujamig,	Doomja, d,hoonja, tokja,	Koolbung, bujabung.
„ Build,	Pangmig, langshemig,	Chozha, cheekzha,	Lenmung.
„ Bring,	Leamig, kermig impkera,	Khoorzha, k,hebzha,	Repung imp. Bret. rikpung.
„ Bore,	Kamig,	Pookcha,	P,heokpung.
„ Break,	Choongmig, tookmig, toonmig	Chokcha, choomzha, chakja,	Keakpung, imp. kea.
„ Boil,	Skooanig,	Kolzha,	Kooatpung.
„ Blow,	P,hooeamig,	P,hoozha,	(B. imp. Raee.)
„ Bring,	Kanmig, karmig, leshis-mig, kashkemig,		
„ Bury,	K,harung, kormig,	Sana-lokcha,	Matungchee-hanmung.
„ Bite, Sting,	Burangmig, cheengmig,	Mookcha,	Cheepung.
„ Bray, Neigh,	Bushushmig,	Kacha,	Busutpung.
„ Bark,	Choolmig, chool-tongmig,	Kacha,	Zoolbung, busutpung.
„ Blow the Nose,	Seetung,-yoongmig,	Nachoo-peeja,	Seebung-serbung.
„ Count,	Narmig,	Cheezha,	Shoommung.
„ Cook,	Lunnig,	Chozha,	Lenmung.
„ Call,	Koonig, imp. koon, koot,	Bocha, imp. bot, kucha,	Hotpung. imp. hot.
„ Cohabit,	Goshmig, gonmig,	Geoja, imp. go,	Goolbung.
„ Cough,	Choomig,	Ook t,hookcha,	Depung, imp. det.
„ Carry, Carry off,	P,heemig, keramig,	Kerzha, k,herzha,	Kamchee, lopung.
„ Converse,	Batung, lonmig,	Kucha-lupcha,	
„ Crawl,	Syooms-yoonmig,	T,honja,	Wungpung.
„ Come out,	Doounmig,	Chacha, chakcha,	Wokpung.
„ Cut,	Mulmig,	Shokja, yongzha, keocha,	Rabung, imp. raee.
„ Come,	Boonmig, zhamig, zheeramig,	Lebzha, p,hepja,	

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
To Dwell,	Busunig, neemig.	Chaksha.	Busutpung.
„ Die,	Sheemig,	Sheezha,	Sheechbung.
„ Do,	Lanmig,	Pecha, geazha, chozha, checha, bezha.	Lemung, imp. len.
„ Drown,	Doobeamig,	Doorzha,	Doobeatpung.
„ Dive,	Teeo-beemig,		
„ Drink,	Toongmig,	T,hoongja,	Toongmung,
„ Descend,	Yooa-beemig,	Deeroo-shokzha,	Deeroo-rabung.
„ Dance,	Chamig,	Soonzha, chezha,	Shonmung, garbung.
„ Dig,	Kormig,	Kokcha, kocha, doozha,	Korbung, kotebung, imp. kotaee.
„ Divide,	Kangmig, achemig,		
„ Dream,	Mangmig,	Meengzha,	Mangmung.
„ Dry,	Charmig,	Kamzha,	P,hopung.
„ Eat,	Zamig,	Saja,	Zabung, imp. zaee, za.
„ Fight,	Rashmig, dashmig,	Zingre-peecha, nolja,	Bilsheebung, koolsheebung.
„ Find,	Puremig, puramig,	T,hopcha,	Purutbung.
„ Fall,	Gormig, brook-beemig.	Deelja, p,herja, dimzha,	Keshbung, kekshbung.
			Reeabung.
„ Forget,	Bushmig, bushemig,	Jutcha,	Lotpung.
„ Fear,	Beangmig,	Zheekcha,	Gearbung.
„ Fire (a Gun,)	Pyamig,	Geopcha,	Tatpung.
Fill,	Poongmig, boongmig,	K,hongzha, k,hangzha,	Peenpung.
Flow,	Bongmig, bohemig,	Dozha, geookcha,	Boetpung.
„ Give,	Ranmig, kemig, imp. ken,	Tocha, tacha, terzha, karzha, tongzha, t,hocha,	Dabung, k,hebung. imp. daee.
„ Get drunk,	Keosmig,	Rarozha,	Yeopung.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
To Get up,	Surshmig,	Longzha,	Shotpung.
„ Gather,	T,homig,	Dookcha,	T,hootpung.
„ Groan,	Choonesmig,	Khooncha,	K,hoonmung.
„ Grind, (beat,)	Yoonming,	T,hokhja, takzha,	Hooeetpung, tokpung.
„ Gape,	Khakangskamig,	K,hapeja,	Ak,hoabung.
„ Go,	Beemig, imp. baee,	Dozha, songzha, ringzha,	Debung.
	Beenmig,	P,hooja,	
„ Hunger,	Onmig,	Tokzha,	Krebung.
„ Hack,	Chomig,		
„ Hear,	T,hasmig, rochmig,	Chorzha, neanja,	Roongpung, gopung.
„ Hang, (a thief,)	P,haeeoshmig,	Chang chang choopcha,	P.hansee-dabung.
„ Invert,	Gomlanig,	Khabook-checha,	Gom-lembung.
„ Jump,	Goamig, langshemig,	P,hakcha,	Goangpung.
„ Knock,	Tok,hamig,	Doongzha,	Koolbung.
„ Kill or Beat,	Sandmig, sanmig, imp. sat,	Socha, Sacha,	Satpung.
„ Keep,	Tamig,	Borzha.	Tabung.
„ Kick,	Spugus-ranmig,	T,heo-geabcha,	Pukchoo-tapung.
„ Know, Understood,	Nemig, gomig,	Shezha.	Sepung.
„ Knead,	Stemig,	Zeezha,	Moochamung Imp. moochaee.
„ Lick,	Lemming,	Dakcha.	Lembung.
„ Lie down,	Kherdishmig,	T,hetdacha,	Pretpopung Kherpopung.
„ Learn,	Koosheemig,	Lapcha,	Lupsheebung.
„ Let go,	Charamig,	Keorja, churja, tonzha.	Plootpung.
„ Laugh,	Wannig	Gocha,	Wotpung. Kangsheebung.
„ Live,	Shoongmig,	Sonzha,	Seengbung.
„ Light, (a fire,)	Parmig,	Barzha, Tangzha,	Chotpung.
„ Look,	Damig	Chalzha,	P,hatpung, t,hangmung.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
To Load, (a gun,)	Poongmig,	Kangzha,	Peenmuug.
„ Milk,	Choormig,	Zhozha,	Choorbung.
„ Melt,	Gulamig, guladmig.	Zhoozha,	Golatpung.
„ Mend,	Tooninakeo-lanmigtoonamig,	Toor-geapcha,	Toonabung.
„ Make, do,	Lanmig,	Zozha, lynzha,	Lemung. imp. len.
„ Mix,	Skormig, shkonmig,	Tezha, Tookhja,	Koobung, thoeabung.
„ Measure,	Reennig,	Reenzha,	K,hooroo-p,heakpung.
„ Nourish,	Yongmig, palamig,	Talzha,	Keotpung.
„ Open,	Tongmig, toangmig,	Pootzha peja,	P.hebung, pebung.
„ Obey,	Muneamig,	Cheezha,	Munabung.
„ Plant,	Rameamig,	Chookcha,	Romeabung.
„ Place, imp. shet,	Shenmig, taomig, thomig,	Porzha, jupcha,	Tabung. chakpung.
„ Plough,	Hulung-lanig,	Zheeng-mozha,	Hulus-lenmung meobung.
„ Press,	Changmig,	Chakcha,	Chakchakpung.
„ Petition,	Urz-lanmig,	Zhooa-p,hoolzha,	Urz lenmung.
„ Play,	Yochmig,	Cheja,	Geabung.
„ Pound,	Koolmig,	Doongzha,	Koolbung.
„ Push,	Yoonig,	P,hoolja,	Nookpung.
„ Print,	Par-rannig,	Par-geabcha,	Par-totpung.
„ Pull,	Dammig, d,hamig imp. dap.	T,hingzha, t,henzha,	Dapung, imp. dap.
„ Prick,	T,hopeamig,	Chookcha, sookcha,	P,heokpung, googbung.
„ Put on (clothes,)	Pooksheemig, imp. pooksheen p.hoksheemig,	Goenje, imp gon,	P,hoocheebung, imp. p,hoocheen.
„ Root out,	Toanmig, imp. toat,	Jubcha, p,hocha, pokhja,	P,hoonmung.
„ Remove,	Seamig,		
„ Ring (a bell,)	Bajamig,	Doomja, doongzha,	Bujabung, imp. bujaee.
„ Read,	Purusmig,	Dokcha,	Seelbung.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
To Run,	D,hyamig, t,hooremig,	Geookcha,	Galbung, grulbung. bœtpung.
„ Ride,	Deshokshimig, Shokshemig,	Zhonzha, shonzha, zonzha,	Shooksoobung.
„ Roast,	Poksheamig,	Shakcha,	Rotpung.
„ Roll up,	Meteumig,	Tilja.	Meteabung.
„ Reap,	Cholamig,	Gnazha,	K,hobung.
„ Run away,	Bohmig,	Shorzha,	Bropung.
„ Rain,	Budomig, lugdomig,	Yoanzha,	Ruga, bung.
„ Stab,	Gosh-ranmig,	Choozha,	Chootpung.
„ Slip,	Brench-Eemig, blenmig,	Decha,	Bletpung.
„ Stoop,	Rong-beemig,		
„ Sing,	Ganmig, lamig, lanmig,	Tonzha, lenja, tongzha.	K,herbung.
„ Sit, stay,	Toskeemig imp. toskeen, toshmig,	Docha, zokhzha, zokhja.	Popung.
„ Sell,	Rennig, imp. ret, ren,	Chongzha, chomsha,	Rungmung.
„ Speak,	Lonmig, lushmig, tachmig,	Lupcha, serja, lopzha.	Lopung, lokpung.
„ Search,	P,hochismig, poeheemig,	P,hocha, chalja,	P,hatpung.
„ Stride,	Langshenig,	Chong nezha	Chongpa-tutpung.
„ Swim,	B,houbeemig,	Choola-keal-geapcha.	Keal-tutpung.
„ Stand up,		Kagzha. langzha,	Shotpung.
„ Snatch, sure,	Choommig, asarchoomig,	Zoomja,	Choommung.
„ Shave,	Chongmig,	Chacha,	Gnokpung.
„ Silence,	Tamtoshmig,	Tame-docha,	
„ Smell,	Stamig,	Noomzha,	Moonmung.
„ Spit,	T,hoo bung-choarmig,	Chemzha, lootpa-thookcha,	Latee-p,henpung.
„ Shut,	Peenmig, imp. peet,	Chookcha, Geapcha, joopja,	Peekpung, imp. pee.
„ Sleep,	Yangmig,	Nealzha,	Goochbung,
„ See, look,	K,heamig, tangmig,	Tozha, taja; thongzha, thooja,	Kanmung, tungmung.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
To Steal,	Choramung-damig	Koozha,	Khootpung,
„ Shew,	K,heemig,	Tanja,	Kangmung,
„ Split,	P,holmig, Parmig, p,hangmig,	Chacha, shakhzha,	P,holbung.
„ Sew,	Ponmig, chemmig,	Chimzha,	Poonmung, ponmung.
„ Spread,	Pooshthenig, planig,	Teengne-tongzha,	T,heenga-dabung.
„ Sow,	Pooshmig,	Tapja,	Peetpung.
„ Serve,	Dang-lanig,		
„ Say,	Ringmig	Soorja, sorokcha,	Ringbung.
„ Turn out,		Toniongzha,	K,herbung, k,helbung,
„ Thirst,	Teeksarmig,	Komzha,	Teekarbung.
„ Tear,	Chermig, cheerumig,	Chotzha, chacha,	Cheerabung.
„ Throw,	Chourmig,	Dimzha, Dimtungzha,	Reenga-k,herbung.
„ Tie,	Choonmig,	Tomja, domja, keekcha,	Choonmung.
„ Take up,	T,hoomig, tolamig,	Kobzha, takcha, toghzha,	Tekpung, tepung.
„ Tremble,	Lismig,	Darzha,	Kreengmung.
„ Twist,	Booshmig,	Dimzha,	Kr,inmung.
„ Take a walk,		Koora-koorzha,	Kora-korbung.
„ Take,	Yamig,	Lenja, noenja, kherja,	T,habung, t,hoabung imp. t,hoaee detpung.
„ Tumble,	Dunnig,	Borzha,	Reeabung, kepung.
„ Take out,	Toanmig,	Tonzha,	Hanmung.
„ Take aim,	Teekeamig,	Chanee-geoopcha,	Lenga-tatpung.
„ Take,	P,heemig,	Neozha, yazha,	Yapung,
„ Unloose,	Thormig,	Tolzha,	P,harbung.
„ Walk,	Yoonmig, beemig,	Dozha,	Debung.
„ Whisper,	Nelote-lonmig,	Dozook-serja,	Onea-lokpung.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
To Weave,	Tungmig,	T,hakcha,	Takpung.
,, Wash,	Cheemig,	Toozha, t,hooja, shalja.	Oorbung.
,, Weep,	Krammig,	Goonja, gnoozha,	Toebung.
,, Write,	Chemig,	Teezha,	Chebung.
,, Whistle,	Shooshooling-lanmig,	Shooshoo-serja,	Shooshee-lepung.
,, Weigh,	Tolamig,	Korzha,	Tolabung.
,, Wake,	Tosheemig, sarmig,	Goolja,	Tekpung.
,, Wish,	Geamig,	Goezha,	Geoonmung.
,, Warm,	Parshmig,	Dezha,	Toshbung.
,, Yawn,	Hushkamshmig,	Hahaeezha,	Hushkamung.
,, Yoke, (in a plough,)	Tocheamig,		
Am,	Took,	Yook,	
Is,	To, doon, doo,	Yot, hin, dook,	Nee, Sa, hin.
Are,	Ton,	Yoze, yoen, yot,	

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
Hold your tongue,	1 2 silent remain Tam tosh,	1 2 Tame dot,	1 2 Tamna po.
How old are you,	1 2 3 4 5 how many years have gone to you 5 4 Te bursung beeo ka lo,	5 4 2 1 3 Keotla lo cham song,	5 4 1 2 3 Gnano ene bursung de.
1 2 To-day it is cloudy,	1 clouds 2 Toro zhoo to,	1 2 3 4 to day sky cloudy is Diring num t,hinga yut,	1 2 3 4 Diring num dinga ta.
1 2 In the hand,	2 1 God o,	2 1 2 1 Luktoo, lakpa la,	2 1 La goon.
1 2 3 Go with him,	3 2 1 Noo dung beeo,	3 2 1 P,haee laroo song,	3 2 in company 1 Uroo dung yambo de.
Oh man,		{ P,hagee dung song, { Meenjee,	3 2 1 } Uroo dung de.
1 2 Are you well,	2 1 2 1 Dam to, dambasheton,	2 1 2 1 Gamo yot, jakpo yoze,	2 1 Epo nee.
In the arms (embrace,)		Pangdoo,	
1 2 The fire has gone out,	1 2 Me beetkeo,	1 did die Me sheeo,	1 2 Me beekcha.
1 2 3 Who is there,	3 1 Noa hatto,	1 2 Soo hin,	1 2 Soo nee.
1 2 3 What is the price,	3 1 2 Molung t,he to,	1 3 2 Chee reeng yut,	1 3 2 Kha molunge nee.
Come,	Zheera,	P,hep,h,	Runa.
1 2 Where is it,	1 2 Hum to,	1 1 2 Kangdoo, ganayot.	1 2 Go nee.
2 1 3 What is the price,		3 how much 2 Reen chum him,	how much 3 Ene molung.
Very early,	Kantee keebrung,		

ENGLISH.	MILCHAN.	B,HOTEEA, OR TARTAR.	T,HEBURSKUD.
Turn him out,	To toa shet,	Tontong,	P,hana k,her, p,hanak,hel.
How many times have I told you,	1 1 2 Tenjubur, te-lok,	1 1 2 Chamcha,-cham,-lupsong,	1 2 Enekta lokee.
Silence,		K,hatoo toong, k,harokpa dot, zal toksho,	
Stop,	D,hen tosh,		
1 2 Come down,	2 1 2 1 Shoong zha, shoong zheera,	2 1 Mala shok,	2 1 Yat raee.
1 2 Go up,	2 1 Ring beo,	2 1 Yala song,	2 1 Lo de.
1 2 Come here,	2 1 Lo zha,	2 1 Deeroo shok,	2 1 Oea raee.
1 2 Go along,	2 1 Nes beo, paenj beeto,	2 1 Phula song,	Boet kade, duroo de.
Take care,	T,hulun ral,	Ta cheek, tanesong cheek,	Kan chee.
1 2 3 Where are you going,	2 1 3 3 Ku hum-beetun-betish,	2 1 3 K,herung gana-songzha,	2 1 3 3 Gnan go-deno- debung.
1 2 3 4 Where is your house,	3 4 1 2 2 Kan keem hum to doon,	3 4 1 K,herung k,hangba kangdoo,	3 4 1 2 Gnan keoon go nee.
1 2 3 4 What thing is that,	4 1 2 3 Yo the bust to,	1 2 3 Chee zok hin,	1 2 3 K,ha bus hin.
1 2 3 Where are they going,	these men 1 3 3 No mee hum-beetish-beeto,	2 1 3 Deeba gana do,	2 1 3 Urteeshe go denee.
1 2 3 4 5 When will you go to your house,	4 5 3 1 2 Kan keem o terung beeten,	4 5 3 1 2 K,herung k,hangba la nam doen,	4 5 3 1 2 Gna keoom un enoo denoo.
1 2 3 4 Give this to him,	2 4 3 1 Yo no pung ran,	2 4 3 1 D,hee p,hayee la t,hot	4 1 4 3 1 Uroo daee wado, daee.

ENGLISH.	MILCHAN.	B,HOTEA OR TARTAR.	T,HEBURSKUD.
1 2 3 4 Give me something to eat,	2 3 food 1 Ungo chuta zamo ken un- 2 grung,	2 3 4 1 Gna chang saja kare,	4 1 Zabung k,he.
1 2 3 Take it from him,	3 2 1 2 Noo dux kera or pung,	3 2 1 P,hagee na len,	3 2 1 Uroo chee t,hoaee.
1 2 Take up this,	2 to 1 No pung tolao,	2 1 D,heela koltong,	2 1 Ace tek.
1 2 3 4 5 This is my sleeping place,	3 4 5 2 Ung yangmig pusrung to,	1 3 4 5 2 D,hee gnarung nealsa hin,	1 3 4 5 Aee gee goojbe polung.
1 2 3 4 5 How far is it from this,	5 4 1 2 3 1 Zhoo uks te-warik to, tera,	5 4 2 1 3 D,hee na t,hagring chum yot,	5 4 1 2 3 Aee che ene warko nee.
1 2 3 Take it from me,	3 2 1 Ung buksh kera,	3 2 1 Gnarung na k,her,	3 2 1 Geo che det.
1 2 3 4 What is the name of that 5 village,	4 5 1 3 2 Yo deshung the namung to,	4 5 1 3 P,hagee yool chee mheen,	4 5 3 1 Uro deshung meen k,ha.
1 2 3 4 5 What load is on your 6 back,	5 6 2 1 Kan pooshting barung t,he 3 to,	5 6 4 1 K,herung geab la chee 2 3 K,hooroo yot,	5 6 4 1 2 Gna geab to k,ha barung 3 nee.
1 2 3 4 Whose house is this,	4 1 2 3 No hatts keem to,	4 2 1 1 D,hee k,hangba-soenda-sooee	4 1 2 3 4 Ado so keoom ta aee 2 1 keoom soee.
2 3 Where do you stay,	2 1 3 Keena hum neetoon, 2 1 3 ka hum busetun,	2 1 3 K,herung gana dutoo,	2 1 3 Gnan go pobung.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
1 2 3 What like is the road, ...	3 1 2 Om hales to, ...	3 1 2 Lam cheenda yot, ..	3 1 2 Am khunea nee.
1 2 3 Is it an ascent or descent, ...	3 1 2 1 Zhup to tang to, ..	2 1 3 1 Gen yot thoor yot, ..	2 1 3 1 Tang nee t,hoor nee,
1 2 3 How many stages is Kanum 4 5 6 village from this, ...	6 5 3 4 1 Zhoo uks Kanum deshung te 7 8 days road 2 Dear om to, ...	6 5 3 4 7 Gana Kanum yool shakpo, .. 1 8 Chumgee lam, ..	6 5 3 4 Aee che Kanum deshung 1 7 8 2 ene dear am nee.
1 2 3 In how many days shall I 4 5 6 reach Tankur fort, ...	2 3 1 4 5 Te dear o posheo Tankur 6 gorung, ..	3 2 1 5 Zhangma chum la Tankur, 6 to 5 K,hur la lebin, ..	2 3 1 5 6 Ene dear chee Tankur go- 4 rung nooptee.
1 2 3 Give me some milk, ...	2 to 3 to drunk 4 1 Ungo k,heerung toongmig keo,	2 to 3 4 1 Gna la oma t,hoongja-tong- 1 kare, ...	2 to 3 4 1 Geo pel toongmung k,he,
1 2 3 4 5 Of what country are you 6 native (man,) ...	5 2 3 1 4 do you stay. Ka hum moolk o-tontosheton,	5 2 village 1 6 K,heorung gang yool ge mee	5 2 3 1 6 Gnan go moolk ge mee.
1 2 3 4 Who built this house, ...	3 4 1 2 Yo keem haee-langsheet langeo pangsheet,	3 4 1 2 D,hee k,hangba sooee chosong	3 4 1 1 2 Aee keoom soo soo lenzo.
1 2 3 4 How far is Meeroo, ...	1 2 3 4 Teta dur to Meeroo, ..	4 1 2 3 Meeroo cham t,hagring yot,	4 1 2 3 Meeroo ene warko nee.
1 2 I do not understand, ...	1 2 1 2 Ma nek, Ma ne,	1 2 Me she,	1 2 Ma setee.
1 2 It is very cold, ...	much 2 2 1 Up,har-oshto-lisk to ...	much 2 Mangbo tangmo, ..	much 2 Bong, k,hutkeo.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
1 2 3 From Soongnum to Manes 4 5 it is four stages,	2 1 3 5 Soongnum che Manes poo 6 7 4 days road dear om to, ...	2 1 3 6 Soongnum na Manes zhang- 5 7 ma zhee lam,	2 1 3 Soongnum che Manes. 5 6 7 4 pee dear am nee.
You must give,	1 2 to give is Rannig dook, ...	1 2 Tocha yot, ...	1 2 Dabung nee.
1 There is nothing, something 2 not, ...	1 2 T,hooch me, ...	1 2 Chang met, ...	1 2 K,huleo mane.
1 2 Having taken it out of the 3 4 house, bring it, ..	1 2 3 4 Keem o totoa kura p,heeo,...	3 2 1 4 K,hangba na tonne k,hoor,	3 2 1 4 Keoom un hanga ret.
It is raining, ...		is coming Chirba-cha,-gea,-Yongdook,	Chirba rugunee.
I am much pleased with you,	you with good plea- Kanrung dam bash khoo- sure is shee to	Gnarung k,heourung t,hadook, ...	Gee gnano khooshee ranee.
For your worship,		Ogo p,heela, . ..	Oone cheto.
1 2 You will die of cold, ...	2 1 Liskee sheeden, ...	2 1 Tangmo sheen, ..	2 from 1 K,hatkeo soo seechbung.
You must do, ...	to you to do Keenoo lanmig, ..	you to do Keot pecha hodo, ..	to you to do is Gnano lenmung nee.
1 2 To sing a song, .	2 1 Geetung lanmig, ..	2 1 2 1 Loo lepcha, loo tongzha, ..	2 1 Greb k,herbung.
1 2 3 Why has he not come, ..	1 2 3 T,hoo ma boot, ..	1 1 2 3 Cheep,hila cheela-mayoong,	1 2 does come K,hyro ma rano.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
1 2 Sleep (having slept sit,)	1 2 Yag yag tosh,	1 2 Neal ne dot, Neal go,	1 2 Goojee po.
1 2 3 Having washed, bring,	2 1 3 Chee chee kura,	2 1 3 2 1 T,hoo la k,hila, t,hoo ne 3 2 1 3 k,hoor t,hoo chur k,hoor,	2 1 3 2 1 3 Oorga ret, oorkea ret.
1 2 Let it dry,	1 2 to-day place Charashet,	2 1 2 1 Kam chook, Kamdo chook,	2 1 P,ho mat.
1 2 3 4 What is you caste,	3 1 4 2 Kan the zat to,	3 1 4 2 Keot chee rikh hin,	3 1 4 Gnan ka zat.
1 Give it to whom it belongs,	who is him give Hatto ung to no rannaee shet,	who is him to give him K,hoee hin te la t,hot pha. to gee la,	who is to him give Soee hin wado daee.
1 2 3 Having made, bring,	1 2 3 Lan lan kera,	2 1 3 2 2 3 Zo la k,hela, zo ne k,hoor,	2 1 3 Lenga ret,
1 2 3 4 Is there oil or not,	2 1 4 2 1 Telung to maee, Telung 1 doo madoo,	2 1 4 1 Markoo dooga me doog,	2 1 3 4 Matee nee la mane.
1 2 Tell me (bring word,)	Batung kera,	2 1 Kucha k,hoor,	2 1 Kucha re.
1 2 Run (having run go,)	1 2 D,hyat bee,	1 2 Geookh ne song,	1 2 Boetka de.
1 2 3 What are you saying, 4 What have you said,	2 1 4 Kas t,he ringon,	2 1 3 K,heourung chee lupchee	1 2 3 K,ha ringbung.
1 2 3 Place it on this,	3 2 1 Noo den tas,	3 2 1 Dhee khatookla, por,	3 2 1 Yooee choopcho taee.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
1 2 3 Do not come again,	3 1 2 Nepeks t,ha zheera,	3 1 2 Logh ma yoong chee,	3 1 2 Neka t,ha raeechee.
1 2 3 What shall I do,	2 1 3 Goo t,he lantok,	2 1 3 Gnarung chee petin,	1 3 K,ha lenmung.
1 2 It is dry,	2 1 Chargeo, to,	Kamsong,	2 1 2 1 P,ho nee, P,hoka nee.
1 2 3 4 From whence have you come,	3 2 1 4 Ka humche booen,	2 1 3 4 3 4 Gana-yonge-yongsonge,	2 1 do you come Go che rano.
1 2 3 4 Why has he not obeyed my 5 orders,	4 5 1 2 Ung hookum chera ma 3 muneat,	1 4 5 2 Cheela gnarung ka me 3 cheesong,	4 5 1 2 Gee hookum k,hyro ma 3 munaee.
1 2 It is burnt,	2 1 Bargeo to,	2 1 2 1 Tooka yot Barga yot,	2 1 Rotka nee.
1 2 3 I am not going any where,	3 1 2 Hamee ma beetok,	3 1 2 Ganeung me dogan,	3 1 2 Goeo ma denee.
1 2 3 4 5 6 If I come to your house what 7 8 will you give me to eat,	4 5 3 2 6 Kan keemo bootook t,he 6 food 7 t,he zamoo keten,	1 4 5 Gnarung keotkee khangba 3 2 6 8 7 la yongen chee saja tangin,	1 4 5 3 2 Gee gnan keoorn un ranee 6 8 7 kha zabung k,henoo.
1 2 3 Now he has sit down in the 4 house,	1 4 3 2 Hoona keemun toshek,	1 4 3 2 Ta k,hangba roo dot song,	1 4 3 2 Lisungo keoomun poka.
Please to sit down,	Toshenchee,	Dot chee, Dotochee,	Po chee.
1 2 Call him,	2 1 No pung koot,	2 1 P,hagee la kut-geoop,	2 1 Uroo hot.
1 2 3 What is he sowing,	2 1 3 No the pooshetok,	2 1 3 P,haee chee tapge,	2 1 3 Uroo k,ha peetee.

English.	Milchan.	B,hoteea or Tartar.	T,heburskud.
1 2 3 4 Why have you broken this plate? 5 6 at another time take care, 7 8 otherwise I will beat you,	4 1 2 Yo derma chera choongon, 5 6 7 nepeks thulun ral maee 9 8 kanrung satook,	3 4 1 2 D,hee derma cheephila chak- 5 6 7 9 songe dalda tacheek me k,he- 8 ourung satin,	3 4 1 2 Aee derma k,hyro keaka 5 6 7 dulda kan chee manee 9 8 gnano sattee.
1 2 3 I have given this person 20 4 5 6 rupees to buy grain,	3 4 6 5 Neera roopeea choa zongmig 2 1 1 zhola ranook or rak,	4 3 2 1 Mool neeshoo d,heela tatsong 6 5 jukhpe neozha,	3 4 6 5 Neera roopeea broo chong- 2 1 bung wado, daee.
1 2 3 Will you stay or go,	I 2 3 Tosheten kee beeten, 1 2 3 Toshen kee beeten,	1 will you go will you stay Dozhan docha, Doene-doten or dotoen.	1 2 Denoola potan.
1 2 Do you understand or not ? 3 (did you understand)	1 2 have you understood. Neten a ma nen, a is put in for the sake of the sound,	3 2 3 She me she, 1 2 1 Shekane me shezhe,	1 or 2 1 Sela ma seno.
1 2 3 Will you go, or not,	1 2 3 have you gone Beeto kee ma been, n omitted before kee,	1 3 did you go Doene me do,	1 2 3 1 De la ma denoo.
1 2 3 Will he come, or not,	1 2 3 has he come Booto kee ma boot,	1 2 1 Yoongan me yoong,	1 2 3 1 Ra la ma ramee.
1 2 Shall I come, or not,	1 2 1 Booko ma book, o put in between k and m.	1 2 1 Lebin ma leb,	1 2 1 Nootpung ma nootpung.
1 2 Have you got, or not,	1 2 1 Puruna ma puran, (*a* put in between *n* and *m*,)	1 2 1 T,hobsonge ma t,hobsong,	1 on 1 2 Puracho la ma purat.

ENGLISH.	MILCHAN.	B,HOTEEA OR TARTAR.	T,HEBURSKUD.
1 2 Have you eat or not, ...	1 2 1 Zana ma zan, ...	1 2 1 1 2 1 Sasong ma sa, sa ma sa, ..	1 or 2 1 Zaga la ma zaga.
1 2 Has he eat or not, ...	1 2 1 Za ma za, ...	1 2 1 Sasong ma sa, ...	Zaga maee,
1 2 This is better, ... This is best, ...	1 very 3 good 4 2 Yo up,har dam to,	1 3 4 2 Dhee mangbo gamo yot, ..	1 3 4 2 Yooee bong epo nee.
1 2 Drops are falling, ...	1 2 2 Oshungbudodoo, lugdodoo, ..	1 2 T,hikpa yooantook, ...	1 2 Chokchee rugunee.

MILCHAN.

The Substantives seem to be of the neuter gender, unless animals, for which there are either different words, or the sexes are distinguished by the adjectives male and female.

The cases are marked by terminations, and are :—

Nominative,	Keem, a house.
Genitive,	Keem-o, of a house.
Dative,	Keem-o-pung, to, into, for a house.
Accusative,	Keem-pung-en-oon, a house, or on a house.
Ablative,	Keem-ung-rung, with a house. Keem-che-uks-na-no, from a house.
Nominative,	Ung, I, myself.
Genitive,	Ung-o, mine, of me.
Dative,	Ung-o-lo-rung-pung, to, for me.
Accusative,	Ung-rung-pung-en-oon, me, or upon me.
Ablative,	Ung-che-duks-buks-na-no, from me. Ung-dung-rung, with me.

The cases appear to be the same in the plural, but *a* is sometimes added to nouns ending in a consonant, as *Keema,* "houses." *Keemapung,* to "houses," she signifying all, is likewise added to denote the plural, but it is most generally omitted.

The adjectives have no gender, and I have been able to find no degree of comparison, unless *Uphar,* signifying "very," as *Uphar oarik,* "very, more or most distant."

The imperative singular, which is sometimes a substantive, is the root of a verb, and from it the other tenses are formed.

All infinitives end in *mig* or *nig,* and by dropping these terminations you get the imperative singulars, with a few exceptions; *o* added to the singular forms the plural, but if great respect be meant, *en* or *chee,* and often both used instead of *o.*

When there is a vowel before *mig* after that termination, has been dropped for *n,* is sometimes added for the imperative singular, but if that vowel be *a, ee* is commonly added, and if *mig* follow an *m* or *n,* these letters are usually changed into *p* or *t.*

Toshmig, to sit,	Kemig, to give,	Beemig, to go.
Tosh, sit thou,	Ken, give thou,	Bee, go thou.
Tosho, sit you,	Keno give you,	Beeo, go you.
Toshen, Toshenchee, please to sit,	Kenchee, please to give,	Beeochee, please to go.
	Tha-ken, do not give,	Tha-boeo, do not go.
Tha-tosh, Do not sit.		

Sanmig, to kill,	Dammig, to pull,	Toamig, Toanmig, to take up,	Kooing, to call.
Sat, kill thou,	Dap, pull thou,	Toaee take up thou,	Koon, koot, call thou.
Satosano, kill you,	Dapo, pull you,	Toao, take up you,	Koono, kooto, call you.

PRESENT.

The first person singular of the present tense, is formed by adding "tok, took, tuk, dok or dook," to the imperative singular, and dropping *n*, *p*, t or *ee*, if it end in either of these letters.

The 2d person,	by adding	toon, ton, don, doon,
,, 3d ,,	,,	to, ta, too, do, or doo.
The 1st person plural,	,,	te, tesh, de, desh or dish,
,, 2d. ,, ,,	,,	tesh, tish, ten, den, desh, dish,
,, 3d. ,, ,,	,,	tesh, tosh, desh, te or de,

	Toshmig, to sit.				Lanmig, to do.			
Goo or Goos,	Toshetook,	or	Toshetok,	I sit,	Landook	or	Lanodok,	I do,
Kee ,, Ka,	Toshetoon,	,,	Tosheton,	thou sittest,	Landoon	,,	Lanodon,	thou dost.
No ,, Nos-Zho,	Toshetoo,	,,	Toshetu.	he sits,	Landoo	,,	Lanodo,	he does.
Kishung,	Toshete,	,,	Toshetosh,	we sit,	Lande	,,	Lanodesh,	we do.
Keena-kees,	Tosheten,	,,	Toshetish,	you sit,	Landen	,,	Lanodesh,	you do.
No-nogonda,	Toshete.	,,	Toshetosh,	they sit,	Lande	,,	Lanodish,	they do
Goo,	Ma-toshetuk	or	Toshetook,	I am not sitting, &c.	Ma lanodok,			I do not do, &c.

	Beemig, to go.				Sanmig, to kill.			
Goo or Goos,	beetook	or	beetuk,	I go,	Satook	or	Satuk,	I kill.
Ka ,, Kas,	beeton	,,	beetun,	thou goest,	Satoon	,,	Satun,	thou killest.
No ,, Nos,	beeto	,,	beeta,	he goes,	Satoo		Sata,	he kills.
Kishnug,	beete	,,	beetish,	we go,	Sate		Satesh,	we kill.
Keena,	beeten	,,	beetish,	you go,	Saten		Satesh,	you kill.
Nogonda,	beete	,,	beetesh,	they go,	Sate		Satesh,	they kill.

PERFECT.

The first person singular of the Perfect, is formed by adding "ok, ek, ook or uk," to the imperative singular, if it end in a consonant; but should it be a vowel *k* or *rok* is added.

The 2d person singular by adding a, on, oon, un or after a vowel n or ron,
3d „ „ a or o after a consonant, and k, t, c or ro, after a vowel.
1st „ plural, e, esh or re,
2d „ „ en or ren,
3d „ „ e, re esh or resh.

Ranmig, to gvie.

Goos rak,	I gave
Kas ran,	thou gavest,
Nos rat,	he gave,
Kishung ranne,	we gave,
Kees rannen.	you gave,
Nos ranne,	they gave, [&c.
ma rak,	I have not given,

Boonmig, to come.

Book,	I have come,
Boon or booa,	thou,
Boot or booa,	he,
Booe,	we,
Booen,	you,
Booe,	they,

Lanmig, to do.

Lanook or Lanok,	I have done.
Lanoon „ Lanon,	thou, &c.
Lanoo „ Lauo,	
Lane „ Lanesh,	
Lanen,	
Lane Lanesh,	
Ma lanook,	I have not done.

Lonmig, to speak.

Goos lorok or lok,	I spoke,
Kas loron „ lora,	thou, &c.
Nos loro „ lok,	
Kishung lore „ loresh,	
Kees loren,	
Nos lore „ loresh,	

Toshmig, to sit.

Toshuk or Toshek,	I sat,
Toshun,	thou, &c.
Tosho,	
Toshe „ Toshesh,	
Toshen,	
Toshesh „ Toshe	

Sanmig, to kill,

Sak or Sanook,	I killed, &c.
San „ Sanon,	
Sat „ Sano,	
Sane,	
Sanen,	
Sane,	

The future is the same as the present, unless sometimes in the following instances, where the perfect is used :—

Goos rak, shall I give,	Makek, I will not give.
Kees lanon, will you do,	Ma book, I will not come, &c.

In the above a great deal depends upon the tone of voice and action.

The following are more common.

Beetena ma been, will you go or not (will you go, or have you not gone.)
Rantook ma ranook, shall I give or not (shall I give, or have I not given.)

The perfect is used for the imperfect and pluperfect.
Must is supplied by the infinitive as,

Ungo beemig dook,	I must go, (to me it is to go,)
Keeno lanmig dook,	you must do, (to you it is to do,)
Nopung ranmig dook,	he must give, (&c.

PARTICIPLES.

The present participle is formed by adding *a* to the imperative singular.

Tosha, sitting,	Lona, speaking.

The perfect participle is either the imperative singular alone, or repeated or, *eo*, *keo*, *geo*, or *ka* added to it.

Charmig, to dry,	Chargeo, dry,	Tookmig, to break,	Took took, broken or having broken.
Cheemig, to wash,	Cheechee, washed,	Beenmig, to burn,	Beetkeo, burnt,
Sanmig, to beat,	Sat Satka,	Satkeo, beaten,	

The active verbs are sometimes formed from the perfect participle, with the assistance of Shenmig, to place, Lanmig, to do; and Ranmig, to give.

Sanmig, Sa-shenmig,	to beat,	Cheeramig, Cheera-lanmig,	to split.	Tongmig, Tong-ranmig,	to open.
Sa-shet, Sa-sa-shet,	beat thou.	Cheeralan, split thou.		Tong ran Tong-tong ran	open thou.

Sa shetok, I beat,	Cheera lanodook, I split,	Tong ranotook, I open.
Sa shenook, I have beaten.	Cheera lanook, I have split.	Tong rak, I have opened.

The passive is formed by the auxiliary verbs to be and go.

Sanmig, to beat.	Beenmig, to burn.	Thasmig. to hear.
Goo sasa dook, I am beaten.	Beetkeo took, I am burned.	Thaska took, I am heard.
Ka sasa doon, Thou, &c.	Beetkeo ton, Thou, &c.	Thaska toon, Thou, &c.
No sasa doo,	Beetkeo to,	Thaska to,
Kishung sasade,	Beetkeo te,	Thaska te,
Kee sasaden,	Beetkeo ten,	Thaska ten,
No sa sade,	Beetkeo te,	Thaska te,
Goo sa beek, I have been beaten,	Beet or beetkeo-beek, I have, &c.	Thas beek, I have been, &c.
Ka sa or satke been, Thou, &c.	Beet been,	Thas been,
No sat or satka beeo,	Beet beeo,	Thas beeo,

The tenses might be formed by any of the above terminations, but those only which sound best are used; thus in the verbs Ranmig and Lonmig, the perfect might be Rank and Lonk, but Ranook, Rak, Lonook, Lorok and Lok are softer, and therefore are in use; after *n, g* is sometimes inserted, as Rangook, &c.

In the tenses of verbs, as well as in whole sentences, the Koonawurees pay the greatest regard to sound; consonants are often separated by *a, e* or *o t* and *d, k* and *g* are interchanged, and *d, n, p, t* are usually placed between two vowels, and as often omitted if one word end with a consonant, and either of these letters follow in the next; thus—Toshetook and Lanodook, are used instead of Toshtook and Lantook, Chargeo and Satka are softer than Charkeo and Satga, and in the following:

Nodo, Nopung, to him.

Keemo, Keemung, to a house not Keemdo, Keempung.

Noduks, Noche, from him but.

Keemuks, Keemoduks, Keemoche, never Keemduks, Keemche.

Kano, Kalo, to you; are used in place of Kao and Kanlo.

Sat is the imperative of Sanmig, but Sashet is softer than Satshet, and Chara sehmig is better than Char shemig; many more instances might be given.

esh, ish, tesh, tish, in the plural are used respectfully.

B,HOTEEA OR TARTAR.

Like the Milchan the cases of the nouns are distinguished by terminations, and the adjectives have only one degree of Comparison, Mangbo, signifying much, being prefixed.

Nominative,	Yool, a village.
Genitive,	Yoolge, of a village.
Dative,	Yool-roo-la-doo-le, to, for, into a village.
Accusative,	Yool-la, a village.
Ablative,	Yool-laroo, with a village.
	Yool-na-soo, from a village.

The plural is the same.

The infinitive of a verb ends in *cha, ja*, or *zha*.

The imperative singular is formed by dropping the final terminations, but if the infinitive end in *cha* with a vowel before it, *t* is added ; perhaps it would be more simple if *cha* were written *tzha* or *tsha*, as it is pronounced ; if the infinitive be *kcha* or *kja, h* is added, after dropping the final terminations, and *e* or *a* is sometimes added to form the imperative singular ; the addition of *o* makes the plural ; and *chee* denotes respect, as in the Milchan.

The infinitive is used for the imperative, but very seldom.

Shokja, to come,	Docha, to sit,	Cheezha, to wash.
Shokh, come thou,	Dot, sit thou,	Chee, wash thou.
Shokho, come you,	Doto, sit you,	Cheeo, wash you.
Shokh chee, please to come,	Dochee, please to sit,	Mechee, do not wash.
Meshokh, do not come,	Ma dot, do not sit,	
Chakcha, to cut,	Karzha, to give,	Khelzha, to bring.
Chakh, cut thou, &c.	Kare, give thou.	Khela, bring thou.

There are two present tenses, the most common is as follows:—

The 1st person singular, by adding *ghan* or *gan* to the imperative singular, or the infinitive is made use of.

The 2d person singular, by adding *ghan*, *gan*, *ghane* or gane, or the infinitive.
The 3d ,, ,, ,, ghan, gan, ghe or ge, or the infinitive.
1st ,, plural. ,, ghen or gen, or the infinitive with the addition of *n*.
2d ,, ,, ,, ghen or gen, or the infinitive with the last letter changed into *e*.
3d ,, ,, ,, ghen or gen, or the infinitive, as in the 2d person.

If the infinitive end in *t*, that letter is generally omitted, but it is retained in docha, to distinguish it from dozha., *g* and *k*, *p* and *be*, *t* and *d* are interchanged, and *o* is often placed between two consonants; this tense is sometimes used for the future.

	Dozha, to go,			Pecha, to do.	
Gna,	Doghan,	Dogan, I go,	Pekan,	Pecha,	I do,
Keot,	Doghane,	Doghan, thou goest,	Pekane,	Pecha,	Thou doest.
Phaee,	Doghan,	Doghe, he goes,	Pekan,	Peke, Pecha,	He does.
Net,	Doghen,	We go,	Peken,	Pechan,	We do.
Keozhuk,	Doghen,	Dozhe you go,	Peken,	Peche,	You do.
Wateshe,	Doghen,	They go,	Peken,		They do.

Me doghan, I do not go, &c.

	Docha, to sit,		Songzha, to go; the g is not doubled.		
Gna,	Dotkan,	I sit,	Songan,	Songzha,	I go.
Keot,	Dotkane,	Thou sittest,	Songan,	Songzha,	Thou goest.
Phagee,	Dotke,	He sits,	Songe,	Songzha,	He goes.
Net,	Dotken,	We sit,	Songen,	Songzhan,	We go.
Keozhuk,	Dotken,	You sit,	Songen,	Songzhe,	You go.
Wateshe,	Dotken,	They sit.	Songen,	Songzhe,	They go.

The other present is formed as follows:—
1st person singular by adding *oon* or *oong* to the imperative singular.
2d. ,, ,, ,, o, oo, ook or n.
3d. ,, ,, ,, ook, oon, oong or dook.

1st ,, plural ,, oon or oong.
2d. ,, ,, ,, oon or oong.
3d. ,, ,, ,, o, oon or oong or the infinitive with him.

	Sheezha, to die.	Toongzha, to sing.	
Gna,	Sheeoong, I am dying,	Tongòon,	I am singing.
Keot,	Sheeook, sheeo, sheen, thou, &c.	Tongoo,	Thou, &c.
Phagee,	Sheeook, sheeoong,	Tongoon, Tongodook.	
Net,	Sheeoong,	Tongoon.	
Keazhuk	Sheeoong,	Tongoon,	
Wateshe,	Sheeoong sheeo,	Tongoon, Tongzha hin.	
		Me tongoon,	I am not singing.

IMPERFECT.

1st person singular imperative alone, or with the addition of *a*
2d. ,, ,, ,, ,, ,, ,, *e*
3d. ,, ,, Imperative alone or with *o*
1st ,, plural ,, ,,
2d. ,, ,, Imperative plural.
3d. ,, ,, ,, singular.

	Songzha, to go,	Tacha, to give.
Gna,	Song, songa, to go,	Tat, I did give.
Keot,	Song, songe, &c.	Tat, Thou, &c.
Phaee,	Song,	Tato.
Net,	Song,	Tat.

Keozhuk,	Songo,	Tato.
Wateshe,	Song,	Tat.
	Me song, I did not go.	

PERFECT.

The perfect is the imperative singular with the addition of song ; throughout *a* is sometimes added to the 1st person singular, &c. to the 2d persons singular and plural.

	Phoozha, to go.			Tacha, to give.
Gna	Phoosong,	Phoosonga,	I have gone.	Tut song, I have given.
Keot,	Phoosong,	Phoosonge,	Thou, &c.	Tat songe, Thou.
Phaee,	Phoosong,			Tat song.
Net,	Phoosong,			Tat song.
Keozhuk,	Phoosong,	Phoosonge,		Tat songe,
Wateshe,	Phoosong,			Tat song,
				Me tatsong, I have not given.

FUTURE.

The future is formed by adding *en* to the imperative singular, unless in the 2nd and 3rd persons singular, the former of which is by the addition of *ene* and the latter by *e ;* after *t* the *en* becomes *oen.*

Zozha, to do.		Docha, to sit.	
Gna zoen,	I will do.	Dotoen,	I will sit.
Keot zoene,	Thou, &c.	Dotoene,	
Phaee zoe,		Dotoe,	
Net zoen,		Dotoen,	
Keozhuk zoen,		Dotoen,	
Wateshe zoen,		Dotoen,	

PARTICIPLES.

The present participle is formed by *a*, the perfect by *ka* or *pa*, and the compound perfect by *la*, *chur*, *jur* or *ne* added to the imperative singular.

Docha,	to sit.
Dota,	sitting,
Dotka,	sat,
Dochur,	having sat,

T,hoozha,	to wash,
T,hooa,	washing,
T,hooka,	washed,
T,hoone, T,hoojur T,hoola,	Having washed,

P,herzha,	to fall.
P,hera,	falling.
P,herka pherpa,	fallen.
P,herne, P,herchur,	having fallen.

In a negative sense the imperative is used at times for all the tenses.

as Me zo,	I do not, I will not do, or shall I do, I have not done.
Me tat,	I do not give. I will not give. I have not given.

The imperative is frequently used with the following verbs, Tongzha, Zerja, Geoopcha, and Kozha.

Tonzha, Tontongzha,	to turn out,
Tontongan,	I turn out,
Tontong,	I did turn out,
Tontongson,	I have turned out,
Tontongen,	I will turn out,
Tontong,	turn out.
Metontong,	I did not turn out.

Shokzha, .. Shok zerja,..	to come.
Shok zerin,	I will come.
Shok zersonge,	You have come.
Shok ma ser,	he did not come.

Chongzha Chong geoopcha,	to sell.
Chang geoopkan,	I sell.
Chong geoop,	I did sell.
Chong geoop song,	I have sold.
Chong geoop chee,	please to sell.
Ma chong geoop,	he will not sell, &c.

Zheekcha, ... Zheek ko zha,	to fear.
Ma zheek chee, Zheek me ko,	do not fear.
&c.	

The passive is formed by the perfect participle and the auxiliary verbs, yozha, to be ; and songzha, to go ; I have only discovered two tenses.

Chorzha, to hear.	Present.	Barzha, to burn.	
Chorka yoon,	I am heard.	Barga yoon,	I am burned.
Chorka, yoze, Chorka yot,	thou heard.	Barga yoze.	
Chorka yot, Chorka dook,	he is heard, &c.	Barga yot, &c.	
Chorka yoon, Chorka yot,			
Chorka yot, Chorka yoze,			
Chorka yot,			

PERFECT.

Sat ka song, I have been beaten,	Barga song, I have been burned.
Satka songe &c.	Barga songe, &c.
Me satka song, } he has not been beaten, Satka, me song, }	

THEBURSKUD.

The cases of nouns are :

Nominative,	Shung, a horse.
Genitive,	Shunge, shungke, of a horse.
Dative,	Shung-o-do-to-goon, un-na to, for a horse.
Accusative,	Shung-to chopcho, a horse, upon a horse.
Ablative,	Shung-che-chee-soo-un, from a horse. Shung-dung, with a horse.

The plural is the same,

The adjectives have one degree of comparison, Bong, meaning more or most being prefixed.

The infinitives of verbs end in *mung. pung* or *bung ;* and the imperative singular is formed as in the other languages by dropping these terminations, after *a*, *ee* is added, and *a* sometimes follows a consonant; the addition of *o* makes the plural, and *n* after a vowel, or *en* after a consonant, and chee denote respect, the infinitive is also occasionally used for the imperative.

Bujabung, to beat.	Moochamung, to knead.
Bujaee, beat thou	Moochaee, knead thou.
Bujaeo, } Bujao, } beat you.	Moochaeeo, knead you.
Tha bujaee, do not beat.	{ Moochaee chee, } { Moochaeen, } please to knead.
Kekshbung, to fall.	Reeabung, to fall.
Ma keksha, } Tha kekshbung, } do not fall.	{ Ma reeachee, } { The reeaen, } do not fall.

PRESENT

The present tense, which is also the future, is formed

1st	person	singular	by adding	nee, tee, dee, to the imperative.
2d	,,	,,	,,	noola, toola, doola, tanla, danla.
3d	,,	,,	,,	nee, tee, dee, neela, teela, tala, deela, dala.
1st	,,	plural	,,	nee, tee, dee.
2d	,,	,,	,,	no, noo, nun, to, too, tan, do, doo, dan.
3d	,,	,,	,	nee tee, dee.

The infinitive is also used for the 1st, 2d and 3d persons singular, if the verb end in tpung, *t* and *p* are interchanged sometimes.

Debung, to go.	Sepung, to know.
Gee denee, debung, I go,	Setee sepung, I know, &c.
Gnan denoola, debung, Thou goest.	Setoola, setanla.

Uroo deneela, denee, debung, ..	he goes,
Eneshe denee, ...	we go,
Gnanee she deno, denoo, denan,	you go,
Urteeshe denee, ...	they go,
Ma denee, ...	I will not go.

Lenmung, to do.

Gee lendee, lenmung, ...	I do,
Gnan lendoola, lendanla, ...	thou, &c.
Uroo lendee, lendala, lendeela, ..	
Eneshe lendee, ...	
Gnaneeshe lendo, lendoo, lendun,	
Urteeshe lendee, ...	

Setee, setala, seteela.
Setee,
Seto, setoo, setan.
Setee.

Nootpung, to come.

Nooptee, I come.
Nooptoola, thou, &c
Nooptala.
Nooptee.
Noopto
Nooptee.

PERFECT OR IMPERFECT.

The person is formed as follows:—

1st	person	singular	by adding	kee	or	gee,	to the imperative.
2d	„	„	„	ka	or	ga.	
3d	„	„	„	ka	or	ga,	or the imperative alone.
1st	„	plural,	„	cho	or	zo	or the imperative.
2d	„	„	„	cho	or	zo	
3d	„	„	„	cho	or	zo	

Dabung, to give.

Gee dagee, I have given.
Gnan daga, thou, &c.
Uroo daga, daee,

Satpung, to kill.

Sakee, I have killed, &c.
Satka
Sat, satka.

Enshe dacho, dazo, daee,	Sacho.
Gnaneeshe dacho, dazo,	Sacho.
Urteesho, dazo,	Sacho.

With *ma*, the perfect is often used as the future and present, as *Ma dagee*, I am not giving, I have not given, I will not give.

The imperative is also used in the same sense, and in asking a question, Ma daee, I will not give, &c., daee, did he give, or shall I give

The present participle is the imperative alone, or with the addition of a; the perfect is formed by adding *ka*, and the compound perfect by adding *ka* or *e*.

De, going.	Lena, doing.
Deke, gone, having gone.	Lenga, done.
.. .. ..	Lenga, lene, having done.

The imperative, present or perfect participles, are sometimes used with the verbs *kherbung*, *tatpung*, and *geoonmung*.

Ploota kherbung, to let go.
Poka tatpung, to sit down.
Gear geoomung, to fear.

The passive is formed by the imperative alone, or with the addition of *ka* or *cha*, and the verbs to be and go.

Gee sacha, satha-nee, I am beaten.	Sat, satka degee, I have been beaten.
Gnan sacha nee, &c.	

There is a dialect peculiar to the small district of Zhungram. I believe the words are the same as the Milchan, but the infinitives of the verbs end in *ens*, the following are a few of them:—

To eat,	Zaens.
drink,	Toongens.
sit,	Posens.
give,	Khedens.
speak,	Chulens.

The dialect spoken in the district of Soomchoo, differs from the others, principally in the tenses of the verbs, but some of the words are likewise different. The following are a few :—

English.	Soomchoo.	English.	Soomchoo.	English.	Soomchoo.
Man, ...	.. Mee.	Dog, ..	.. K,hooee.	Finger, ..	.. Branch.
Woman,	.. Esplung.	Cat, ..	.. Peeshee.	Foot, ..	.. Bunkun.
Carpenter,	.. Oris.	Monkey, ..	.. Bundrus.	Back, ..	.. Geab.
Shoemaker,	.. Chamung.	Mouse, ..	.. Peeoots.	Hair, ..	.. Kra.
Blacksmith,	.. Domung.	Snake, ..	.. Sabas.	Egg, ..	.. Leelee.
Shepherd,	... Palis.	Hare, ..	.. Reehong.	Heat, ..	.. Kochra.
Thief,	.. Chorus.	Fish, ..	.. Muchus.	Cold, ..	.. Khutee.
Ferryman,	.. Turoo.	Bird, ...	.. Peeach.	Apple, ..	.. Kooshoo.
Yak, ..	.. Yak.	Hawk, ..	.. Paree.	Grape, ..	.. Goon.
Ass, ..	.. P,hoch.	Chukor, ..	.. Kokchera.	Honey, ..	.. Brangsee.
Horse, ..	.. Shung.	Pigeon, ..	.. Pekhra.	Tobacco, ..	.. Tumak.
Bear, ..	.. Hom.	Kite, ..	.. Goldus.	Butter, ..	.. Mar.
Bull, ..	.. Etong.	Bee, ..	.. Brangsee beeang.	Snuffs, ..	.. Nusar.
Cow, ..	.. Rat.	Head, ..	.. Peesha.	Oil, ..	.. Matee.
Sheep, ..	.. Brang.	Throat, ..	.. Golung.	Spirits, ..	.. Rak.
Wedder, ..	.. Kar.	Tooth, ..	.. Soa.	Bees' Wax,	.. Seetung.
Mule, ..	.. Teeoo.	Tongue, ..	.. Le.	Coarse Sugar,	. Gooram.
Goat, ..	.. La.	Mouth, ..	.. Akhot.	Milk, ..	.. Pel.
Female Yak,	.. Breemo.	Beard, ..	.. Daree,	Musk, ..	.. Katrung.
Male, between yak and cow,	Zofo.	Mustachio,	.. Wasung.	Fine Sugar,	.. Shakrung.
		Nose, ..	.. Mor.	Poison, ..	.. Beeshung.
Female, ditto ditto,	Zomo.	Ear, ..	.. Repung.	Tea, ..	.. Cha.
Musk Deer,	.. Roch.	Eye, ..	.. Mee.	Apricot, ..	.. Choolee.
Hog, ..	.. Soorus.	Arm, ..	.. God.	Walnut, ..	.. Kat.

English.	Soomchoo.	English.	Soomchoo	English.	Soomchoo.
Wine,	Greeng.	Plough,	Halas.	Iron,	Chuks.
Sun,	Neemook.	Fort,	Gorung, Khur.	Brass,	Peetul.
Moon,	Gulsung.	Flat Roof,	K heam.	Lead,	Seek
Star,	Karma.	Slanting Roof,	Chuprung.	Mercury,	Mulchoo.
Cloud,	Zhoo.	Field,	Ree.	Borax,	Challe
Water,	Tee.	Cotton,	Rooee	Sulphur,	Gunik.
Snow,	Rus.	Wood,	Sheeng.	Cannon,	Top
Rain,	Mookpa.	Flower,	Mentok.	Matchlock,	Nal
River,	Sumudrung.	Straw,	Boko.	Spear,	Burcho.
Rivulet,	Loonpa	Smoking Pipe,	Gungsa.	Bow,	Zhoo.
Lightning,	Bijil.	Skin for crossing rivers,	Mushkee.	Arrows,	Shim
Thunder,	Goorgooree.	Brass Pot,	Lotree.	Shield,	D hal.
Ice,	Shanung	Cloth Tent,	Koor	Sabre,	Trooal.
Village,	Deshung.	Skin for flour,	K,hoolch	Leaden Ball,	Goolee.
House,	Keem	Steel for striking fire,	Mekcha.	Gunpowder,	Daroo.
Road,	Om.	Rope,	T hakpa.	Fiddle,	Dutaree.
Fire,	Me	Iron Chain,	Shunglung.	Trumpet,	Kunal, runsheeng.
Year,	Bursung,	Pair of Scales,	Pore.	Wool,	Cham.
Day,	Ner.	Hooka,	Jajree.	Cap,	Tepung
Night,	Moonea.	Axe,	Lashta, tok,hee.	Shoe,	Bulrun
Month,	La.	Adze,	Keooch.	Blanket,	Neanglook.
Tree,	Botung.	Saw,	Retur.	Garment of sheep-skin,	Lakpa.
Hill, (large,)	Yooee.	Bellows,	Sak,hool	Ditto of Goat's hair,	K heear.
Range,	Gang.	Knife,	K,hoorts.	Ditto of Blanket,	Chooba.
A God,	Sat.	Gold,	Zung, ser.	Gloves,	Goosub.
Lama's Temple,	Chokten.	Silver,	Mool.	Here,	Oea
Hand Mill,	Gotung.				

ENGLISH.	SOOMCHOO	ENGLISH.	SOOMCHOO.	ENGLISH.	SOOMCHOO
There,	Noa	11	Sahud.	To fall,	Brujema.
How many,	Tuche.	12	Saneesh	,, beat,	Koolma
Yes,	O	13	Sahoom	,, ask,	T,hama.
No,	Mato.	14	Sapoo	,, arrive,	Pusma.
Quickly,	Hal	15	Sanga.	,, give.	K hemma
Below,	Opung.	16	Satoo	,, laugh,	Wanma
I,	Goo.	17	Sashooneesh.	,, break.	T.hama.
Thou,	Ka.	18	Sarge.	,, dig,	Kotama.
He,	Onomee.	19	Sagoo	,, go,	Zhema.
You,	Georung.	20	Neesa.	,, speak,	Chulma
White,	Chang	30	Deoneesa	,, fight.	Matashma
Black,	K haee.	40	Neeshneesa.	,, dwell.	Busunma.
Good,	Epo.	50	Dyneesa.	,, fear,	Bema.
Bad,	Kochung	60	Hoomneesa	,, write,	Chema.
Large,	Che	70	Hoomneesa sa	,, read,	Purusma.
Small,	Chigich	80	Pooneesa.	,, ride	Shokshma.
		90	Pooneesa sa	,, sleep,	Neanma
1	Eet.	100	Gea.	,, see,	K,honma.
2	Neesh	1000	Tong	,, do,	Lamma.
3	Hoom.	The days of the week and months are		,, sing,	Greb-lamma.
4	Poo.	the same as the Milchan.		,, cook,	Lanma.
5	Gna.			,, sew,	Ponma.
6	Took.	To kill,	Sanma	,, bring,	Leama.
7	Shooneesh.	,, run,	Geanma	,, stay,	Pusma.
8	Ket.	,, eat,	Zama.	,, weigh	Kearma.
9	Goo	,, drink,	Toongma.	,, burn	Ronma.
10	Sa.	,, sit.	Posma	,, drown.	Zango zhema.

English.	Soomchoo.
1 2 3 4 5 What is the name of that village, ...	1 5 1 3 2 No deshung the meen tash.
1 2 3 How far is it, ...	1 2 3 Tuche waree tash.
1 2 3 Give me to eat, ...	2 1 3 1 Ungra zamo khe.
1 2 3 Having broken the wood bring it.	2 1 3 Sheeng k.ho kura.
1 2 3 4 Where is your house, ...	3 1 1 2 Kan keem a to.
1 2 3 4 Whose house is this, ...	4 1 2 3 No oongoo keem to.
1 2 3 Where are you going, ...	2 1 3 Ka a zatun.
1 2 3 What are you eating, ..	2 1 3 Ka the zatun.
I am going, ...	Goo zhetok.
Thou art going, ...	Ka zhetuna.
He is going, ...	No zheto.
I have gone, ...	Goo zherik.
Thou hast gone, ...	Ka zheo.
He has gone, ...	No zhere.
1 2 3 Give to him, ...	3 2 1 No ra k,het
1 2 3 Give to me.	32 1 Ungra k.he.
1 2 3 Take it from him. .. .	3 2 1 Noo da t.hao.

The above languages, are spoken at the following places. Milchan in Utharabees, half of Pundrabees. Rasgramee, Wangpo. Tookpa. Yooshooung. Rarung, and part of Gungel.

Theburskud in Soongnum and She aspa.

Zhungram in Zhungram. with the exception of Rarung village. Soomchoo in Soomchoo.

B,hoteea or Tartar, in Hungrung and the Tartar villages of Tookpa; this language. with a few slight variations, prevails at Garoo, Mansurmur. and along the banks of the Brahmapootra to Teshoo Loomboo and Lahassa. it is the native tongue of Ludak. to the Northwest of which country it becomes intermixed with the Toorkee or Turkish, which is spoken in Yarkund. Dr. Gilchrist's Orthography has been used.

Note on the Passes into Hindoostan from the West and North-west, and the use made of them by different Conquerors.

The following Note was prepared for official use and reference, rather than for the prosecution of literary and scientific researches; the interest attaching to the subject at this juncture, will excuse its publication in this shape, without that full citation of authorities and elaborate comparison of statements, which in a more formal Essay might be expected, and for the complete satisfaction of the learned on controverted points would be indispensible.—H. T. P.

The river Indus has always been regarded as the natural boundary of India, but its valley is within that country; the real boundary is the range of mountains that shuts in the elevated plains and arid deserts of Afghanistan.

The Indus, after a course of near 500 miles to the north-west, washing the northern foot of the Himalaya, and fed by tributaries from the north and south, breaks through that chain after receiving the waters of the Gilghit valley from the N. W. The slide of one of the mountains of the pass submerged that valley about a year and a half ago, and the accumulated waters, reopening suddenly the closed passage, produced a most destructive inundation, (the rise at Atuk being no less than sixty feet,) which sent a back stream seventy miles up the Kabool river. The Government wished to have this convulsion of nature examined, and Dr. Jameson was deputed, with the assent of the Sikh government, to follow the river Indus up for the purpose; but the insurrection of the Afghan tribes defeated this intention, and we have consequently no intelligence to be depended upon of any of the passes north of Atuk, where the Kabool river flows into the Indus.[*]

[*] Mons. Court, an intelligent general of the Sikh army has, however, given the following list of the ferry points of the river above Attock: 1. Bazar Hound; 2. Monari; 3. Pehoor; 4. Nachhee; 5. Kabbel; 6. Chitubha; 7. Amb; 8. Durbund; 9. Chuturbahi; 10. Mabera; 11. Toohara; 12. Morer; 13. Didel; 14. Kamache; 15. Buhar; 16. Pachetlehi; 17. Guendoo; 18. Mateeal; 19. Buttera; 20. Jendial and Manial; 21. Kalchi; 22. Palespatan; 23. Pohoogoojee; 24. Koonchir; 25. Jalkoot. We know further that Futeh Khan Vuzeer, carried a force by Durbund and Mozuffurabad to relieve his brother in Kashmeer, before that valley submitted to Runjeet Singh. Mahmood of Ghuzni also went by the same route into Kashmeer, and from thence made an expedition into Kashghur. These routes, however, are only open for a few months of summer, and are not likely to be chosen by an invading force aiming at the conquest of India.

At Atuk, the Indus is considered as entering the plains of Hindoostan, but it is a mistake to consider the navigation as extending to this point from the sea. The river is a torrent for a hundred miles further to Kalabagh, where it passes through a low range, full of salt mines, that runs across from Kohât to Pinddadur Khan on the Jhilum, and in crossing the Punjab, the route from this latter place to Attock is through a hilly country. From the Indus to Kabool, the ground rises to upwards of 7,000 feet above the sea. The Hindoo Koosh is to the north, and another snowy range, called the Sofed-Koh, to the south of the valley, and the spurs from both meeting at the river, leave successive passes, and beds or basins, of which former the Khyber, from its breadth rather than height, is the most famous. The Julalabad basin is on the other side of the Khyber pass; between it and the fertile valley of Kabool, there are eight other passes, and the road leads away from the bank of the river to the south, because the passage is easier where the spurs join the higher range.

The Soofed Koh, or southern ridge of the Kabool valley, is a spur of the Hindoo Koosh, which, shooting out at a point west of Kabool, divides the sources of that river from the stream that waters Ghuzni, and thence sending one branch southward, (which extends even to the sea,) runs due east to the Indus, and terminates in the Kohât country.

This ridge is crossed about nine miles north of Ghuzni, at an elevation not much exceeding 9,000 feet from the sea, and consequently only 1,000 to 1,200 feet above the level of Kabool and Ghuzni; but it is much more elevated in the eastern branch, south of the Kabool valley, where it is called the *Soofed Koh*, white or snowy mountain, because so seen throughout the year. Close along the southern root of the Sofed Koh, is a road called the Bunghish route, communicating with both Kabool and Ghuzni. It has not yet been explored by any British officer, but was proposed to the troops at Kabool as to be followed on their retirement, in order to prevent their junction with General Sale at Julalabad, who had not submitted. The route was rejected as impassable at the season, (January,) because of the necessity it imposed of crossing the Sofed-Koh.

This route has a communication with Kohât, and with Banoo and Kala Bagh, at which latter place, or a few miles below, the river it follows joins the Indus.

Next below the Bunghish route, is that of the Gomul river from Dera Ismail Khan. This route comes in to the Ghuzni valley from the south-east, and through Zoormut, east of Ghuzni, has a communication also with Kabool.

The Gomul route was followed by the late Lieut. Broadfoot of Engineers, and we have a survey and report upon it.

Dera Deen Punah, below Leyra, is the next point of the Indus, from which there is a known route into Affghanistan. It is on the straight line from Feroozpoor to Kandahar, and the pass is south of the Tukht-i-Suleeman, the highest pinnacle of the Sulimani range. It has yet been traversed by no British officer, but a route is marked in most maps as laid down from native information.*

Next below Dera Deen Punah, is Dera Ghazee Khan, the routes from which place westward are equally unknown. This tract of country is under the government of Sawun Mul, the Sikh soobah of Mooltan, whose disposition has not been considered sufficiently friendly, to warrant either the use of its passes, or any attempts to improve our intelligence respecting them. Below Dera Ghazee Khan, the Sulimani mountains take a sharp turn westward, away from the Indus, and there is an indent of triangular shape, at the apex of which is the Bolan Pass to Quetta. The low ground is fertile and well watered under the hills, but is separated from the Indus by a sandy Desert of about ten or twelve miles breadth, in which the rivers of Dadur, Lehri, and Gundava lose themselves in the dry season before they reach the great stream. This tract is the valley of Kuchchee.

The notices to be obtained from history of the use made of these passes respectively in the different expeditions into India, are extremely scanty; the historians generally giving only the date of departure from the different capitals, and the places attacked in succession, with a detail of personal adventures and exploits in the actual fights.

Passing over the progress of Moosulman conquest through Khorasan and Transoxania to Ghuzni and kabool, we find Subuktugeen established at those two places, and contending with the Hindoo Raja of Lahore, (Jypal,) for the possession of Lughman. The Hindoo Raja was the assailant, and suffering from rain, retired from Lughman upon a composition, the surrender of fifty elephants being one of the terms. The Raja, however, was not yet disposed to yield, and returned with a large army of Hindoo allies, stated to have exceeded 100,000 men. Subuktugeen defeated Jypal again in the Lughman or Julalabad valley towards the end of the tenth century of our æra, whereupon the tribes of that valley, and of the Khyber, submitted to the conqueror, and the Lahore authority ended at Peshawur.

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* It has been stated, that Lieut. H. Marsh of the Cavalry, came from Kandahar to the Indus by this route, but I have never seen any notice of the line of road followed by this officer.

Mahmood, the son of Subuktugeen, made twelve expeditions into India; the first ten of which were entirely directed against the Hindoos of the Punjab and Mooltan, and the tenth ended in the final establishment of Moosulman sovereignty at Lahore. Kanouj on the Ganges, and Muthra on the Jumna, were the limits of Mahmood's marches in these expeditions. His twelfth and last expedition took a different direction.

Starting from Ghuzni on the 12th October 1025, A. D., Mahmood reached Mooltan in a month and five days, and there having got together 20,000 camels, he marched across the Desert to Ajmeer, whence he turned south, and taking a place called in *Ferishta*, Nihurwala,* and in the *Rozut-oossufa* Bhŭwara, he reached Somnat on the sea-side close to Patun in Goozrat, in January 1026 A. D. The city and temple were sacked, and Mahmood remained upwards of a year in Goozrat, when his army being weakened by disease and desertions, he found a return by the route he had come impossible. He accordingly marched west to Sindh, and being overtaken by the hot season, suffered exceedingly before he reached Mooltan. In this expedition, and in another immediately following, to punish some Jats of the Mooltan district, he seems to have used the straight road from Ghuzni to Mooltan; viz. that by the Gomul, for he could not otherwise have reached the latter place in a month and five days. None of the historians, however, say by what route he did march on either occasion, the omission of any mention of Kabool, Peshawur, &c. or of other intermediate places, combined with the shortness of the time allowed for the journey; being the proof relied upon for the fact, that he came direct by the Gomul route.

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* Mr. Elphinstone calls this place Anhalwara

The subsequent expeditions into India from Ghuzni, being in support of the dominion thus established at Lahore, and extended afterwards to Dehli, and even into the Dukhun, were not hostile in their traverse of the passes of Afghanistan.

The overwhelming irruption of Chungeez Khan, is therefore the next event in history to be noticed in connexion with these passes.

Chungeez Khan is said to have brought from Mongolia as many as 700,000 fighting men, and his army must have been immense, for detachments from it made expeditions, exceeding in daring and skill, every thing we read of since the march of Alexander to India. He entered by Toorkistan, where his son Joojee Khan, with an advance guard, fought with such determination the whole army of Mohummed Shah of Kharizm, as to induce that prince to yield the open plain, and betake himself to the defence of his cities and fortresses. The principal seats of this king's dominion were in Mawur-ool-Nuhur, that is, in the country between the Oxus and Jaxartes, (the Amoo and Sir rivers,) but the whole country from Ghuzni and Kabool, to the mouths of the Wolga, owed him fealty and allegiance, direct or tributary.

Chungeez Khan advanced himself to Bokhara, sending two detachments under his sons to take Otrar, the principal city on the Jaxartes on his right, and Khojund and other places in Furghana on his left. He was rejoined by them at Bokhara, after they had reduced all the places on that river, so as to secure that base for future operations. In A. D. 1219, Chungeez reduced and utterly destroyed Bokhara, Samarkund, and Bulkh, and while he proceeded against the last named place, passing by and destroying Turmuz, he detached two of his sons against the capital of Kharizm, then called Orgunj, which they reduced after a long siege of seven months. He had thus the whole line of the Oxus at command. His generals had some years before overrun the whole of Kashghur and Yarkund, and had followed up and slain the chief of the hostile tribes of that region at Sir Kool, the source of the Oxus, so that his flanks were quite secure.

From Samarkund, Chungeez had detached a strong army, stated at 80,000 horse, to follow Mohummed Shah into Persia. This detachment admitted Merv, then a place of great consideration, to a composition, and advanced to Herat. The governor, Khan Malik, submitted, and two of Chungeez Khan's generals, Zena or Juna-noyan and Suveda Buhadur, received the submission, and turned towards Nyshapoor and Persia. The third who followed the other two was not satisfied, and insisting on the possession of the citadel, stormed the town, but failed in the assault and was killed. From Bulkh, Chungeez hearing of this disaster, despatched Toolee Khan with a large force, who reduced and established governors in both Merv and Herat, and rejoined his father during his siege of Talikan. Julal-ood-deen, son of Mohummed Shah, had by this time retired to Ghuzni, and, uniting in his cause all the Afghan tribes, promised to make head against the Tartars in the difficult field of Afghanistan. Chungeez marched against him from Bulkh by the road of Talikan, which place cost him a siege of seven months. Seeing the importance of cutting off the Afghans from Persia, where Mohummed Shah also threatened again to make head, Chungeez sent a second detachment of 30,000 horse from Talikan to Herat under three new generals. These advanced from Herat to a place called Sagil, by Abool Ghazee Khan, and supposed to be Kandahar, but I rather incline to think it may be Sakhir, the capital of the Ghor country, then a city of great consideration, or if not Sakhir,* some place on the Helmund, for a river is specifically mentioned. Julal-ood-deen advanced with all the troops of Afghanistan, and giving battle to Chungeez Khan's generals while engaged in this siege, defeated them with great loss and relieved the place. The Afghan chiefs, however, quarrelled about the booty, and one gave the other a box on the ear,† which led to two principal chiefs deserting from Julal-ood-deen's army, one of whom retired to Kurman in Persia, while the other, Khan Malik, went back to Herat. In the mean time, Chungeez Khan had taken Talikan, and advanced to Inderab, which detained him another month, and it was here that he heard of Julal-ood-deen's victory. He immediately advanced by Bameean to Kabool, but lost a favorite grandson, (son of Oghtaee Khan,) at the siege of the former place. Coming suddenly upon Ghuzni, it was yielded to him, and he learned that Julal-ood-deen had made for the Indus river only fifteen days before he arrived. Thither he was followed by Chungeez with such expedition, as to be overtaken and defeated before he could effect a passage. Julal-ood-deen swam across the river with only one or two attendants in sight of the conqueror, whose admiration was much excited by the feat. The site of this battle, which was the limit of Chungeez Khan's irruption in that direction, is not known, nor the routes by which he and his enemy marched for the river, but they must evidently have been in the line east or south-east of Ghuzni; and the Gomul pass was therefore most probably that followed by Chungeez, while Julal-ood-deen went either by the same, or by that which debouches upon Dera Deen Punah.

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* The Rozut-oos-sufa calls the place Valiban, and says it was on the river Baran. This book is a compilation of high authority made by Ameer Alee Khan, between the years 1444 and 1496 A. D.

† The Rozut-oos-sufa says, a blow of a whip.

For the punishment of Herat, Chungeez now sent a third force of 80,000 horse, which taking the place after an assault of six days, left only sixteen persons alive of the entire population. Chungeez returned northward by Bulkh after his victory on the Indus, but was compelled to send back Oghtaee Khan, his fourth son, to quell an insurrection at Ghuzni, and to destroy that city also, which had been saved hitherto, because it had submitted upon capitulation. All these operations were completed in four years, between 1219 and 1222 A. D. inclusive, and this wonderful conqueror returned in the last of these years, in order to complete the conquest of China, which he had effected only as far as the great Yellow River before he entered Kharizm. He died, leaving the remainder to be achieved by his grandson. He was met on his way back by his generals, Juna Noyan and Suveda, who from Herat entered Persia by Nyshapoor, and destroying Toos, Humadan, and all the cities that resisted in the north of Persia as far as Kurdistan, turned round thence by the west of the Caspian, and forcing the Durbund Pass, made good their march to the Wolga, and thence across the Kipchak Desert to Khiva and Kharizm, where Toolee Khan, a son of Chungeez, was firmly established as ruler. As long as history lasts, the astonishment of the world will rest on these achievements, imperfectly as the particulars are known.

We come now to the no less wonderful expeditions of Ameer Tymoor, commonly called in Europe Tamerlane, or Tymoorlung. This conqueror was originally a petty chief of Mawuroonnuhur, but raised himself by the daring and active part he took in the troubles which in his youth distracted that region. Toghluk Tymoor, of the Chungeez family, was induced by these troubles to invade the country from Kashghur. After a spirited defence, Tymoor and Ameer Hoosein, who were then friends and associates, were driven into Kharizm, but on the retirement of Toghluk, they returned and drove out his son Khoja Ilias. Shortly after the two friends quarrelling, Tymoor defeated and slew Ameer Hoosein, and so became sole master of all the country between the Oxus and Jaxartes. He now made successive inroads into Persia, Russia, (wherein he penetrated to the White Sea, in a latitude at which the sun never sets,) Mongolia, Georgia, and Baghdad. After thirty years of ravage in all directions, he determined on the invasion of Hindoostan, being then upwards of fifty-five years of age. His chiefs at first were averse to this expedition, on the ground, as Tymoor himself quaintly writes in his memoirs, that their race would be lost, and their children would speak Hindee, but he reconciled them to it, and having got possession of Herat and Kabool by a mixture of "*nurmee and gurmee,*" mildness and severity, he sent his grandson, Peer Mohummed, eastward from Herat, to prepare the way for an advance to the Indus.

In A. D. 1398, the lower passes of the Sulimani range being forced, Peer Mohummed crossed the Indus, a little below Dera Ghazee Khan, and thence advanced to the siege of Mooltan. In this operation he was occupied six months, during which the rainy season came on, and he suffered very severely, losing most of his horses.

Tymoor himself came by the road of Kabool, and was employed in punishing the Seeah Posh Kafirs of Kohistan, north-east of Kabool, while Peer Mohummed was in the Sulimanee range, as above stated. He followed the tribes on foot, as well from Budukhshan as from the Kabool side, into places quite impassable for cavalry, carrying two horses only for his own use, one of which was killed while being slidden down a glacier in a wooden case stuffed with cotton. Returning after this campaign to Samarkund for fresh troops, Tymoor reappeared at Cabool, and from thence took the Bunghish route by Ayrab, ایراب or Haroob, of which place and Ghuzni, he got possession by treachery. From Ayrab he sent his son Meerza Khuleel to Banoo by the route called in the *Rozut-ool-sufa* Kubjughai, (perhaps Koochi,) while he made an excursion himself against a hostile tribe of Afghans, called Burniani or Purniani. He left their capital on the first of Mohurrum 801, Hijree, (13th September 1398, A. D.) and came out on the Indus at a fort previously built as a dêpot at Nufur.* Thence marching rapidly down the Indus to the point where Julal-ood-deen swam across. after his defeat, (it is specifically so stated in the *Rozut-ool-sufa*, the best historical authority,) he built a bridge across the river in two days and crossed on the 12th Mohurrum, that is in twelve days only from the time of his receiving the submission of the Burniani tribe.

After crossing, Tymoor made directly for the place of confluence of the Jihlum and Chinab, and there reduced a chief, whose capital is described as an island at this point strongly fortified, while he sent a reinforcement to his grandson at Mooltan, and ordered him to join him at Dybalpoor, which lies towards the Sutlej.

Tymoor reducing Talumba, crossed the desert from that place to the old bed of the Beas on the 1st of Suffur of the same year, 13th October 1398, A. D., and on the 7th, captured Gokree or Gourkee: then reducing Ajudia, which yielded and was respected, he effected a junction with his grandson at Dybalpoor, and then prepared to cross the Sutlej, and march on Bhutner in the Desert, where he learned that the Hindoos had collected as in a place of security.

Bhutner is at least sixty, some say ninety miles from the nearest point of the Sutlej, with a waterless Desert for the whole distance. Tymoor, however, made the march in one night with the bulk of his cavalry, surprising there a large store of cattle and supplies that had been collected in full reliance upon the impassability of the Desert.

After massacring the whole population of Bhutner, Tymoor went by Sumana to Delhi, which he sacked. Thence he crossed to the Ganges, and entering the Sewalik or lower range at Hurdwar, carried his army back through the mountains to Jummoo and Kashmeer, and thence to Kabool by the Khyber Pass; thus safely reconveying his enormous booty to Samarkund, where he rested only sufficiently long to prepare for his great expedition westward against Ildrim Bayuzeed.

The invasions of Babir and Nadir Shah present no peculiarities in the routes taken. Babir was established as Sooltan of Kabool for more than twenty years before he made any attempt on India, and then he was invited by the rebellious chief of Lahore, who aided in his first advance to Delhi. He always used the same direct route, and early established a garrison and depôt at Sirhind, in aid of his expeditions. Nadir Shah having established his authority in Persia, took Herat after an eight months' siege, and thence advanced to Kandahar, claiming these as cities of Persia. From Kandahar he advanced by Ghuzni to Kabool, having conciliated the Ghiljie tribes, who had cause of offence against Delhi for neglect in the payment of certain customary stipends. In his march from Kabool, he was unopposed, until he crossed the Sutlej, owing to the distractions and intrigues which then rent the court of Delhi. The battle which opened the way to Delhi was fought at Kurnal, and Mohummud Shah thence carried Nadir Shah to his capital as a friend or ally. The invader returned across the Punjab unopposed as he had come, with the plunder of the palace and capital of the Moghul emperor in his train.

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* This may be Bukur or Nuker. There is a place of the former name at this part of the Indus, but it is on the wrong side of the river.

Ahmed Shah, in all his expeditions, seems to have followed the same route, preferring it apparently on account of the water and forage which is always to be obtained in plenty at the foot of mountain ranges of sufficient elevation, and having garrisons of his own, or of friendly chiefs at Atuk, Lahore, and Sirhind. The march of Nadir Shah is thus the last that can be called an invasion for purposes of conquest.

This notice, however, of the routes and passes into India that have been followed by different conquerors would obviously be incomplete, if the wonderful expedition of Alexander were altogether omitted. It has been reserved for last mention, that the reader may have the benefit of the story of after-expeditions, to assist in the determination of the line of this earliest—the Greek historians having left its course and details somewhat obscure.

The compilation of Arrian is the record of best authority which we possess of the military operations and marches of Alexander; for Quintus Curtius supplies only some fuller details of personal adventures, and a very few additional names. Arrian's seven chapters on Alexander's Expedition are based, as the author states, on the notes of Ptolemy and Aristobulus, who both accompanied the army throughout. His descriptions are sufficiently accurate to enable us, with the lights recently thrown upon the geography of the countries traversed, to identify most of the principal rivers and places named; but there is a sad want of dates and distances in Arrian's narrative, and even the seasons of many of the operations, and the number of months and years occupied in them, have to be guessed from circumstances. On the whole, however, Arrian is a more sure guide in regard to this expedition than any other author of antiquity, and but for the changes of names usual in the Greek version of oriental appellatives, as well as those incident to the course of events in twenty centuries, there would be less difficulty in following him than the Persian and Turkish historians of later expeditions.

After the victory of Gaugamela, in the province of Arbela,* which was gained in October 331, B. C.,† Alexander marched first to Babylon, and then to Susa and Persepolis. The ruins of both Persian capitals have been fully traced and explored, the former is near Shoostur, and the latter about 100 miles north-east of Shiraz. These royal cities Alexander sacked, and then collecting all the camels and beasts of burthen of Lower Persia, he followed Darius to Isfahan, (Ecbatana,)‡ the capital of Media, at the time of this expedition. Hearing however of Darius's flight towards Bactria, he took himself with a light division the eastern route by Yezd to Tabas, said to be the last town of the Paraetaceni, (half way between Yezd and Mushud.) Finding there that he could not overtake the fugitive king before he passed the mountains, Alexander returned to Ecbatana, (Isfahan,) and there rejoining his main army, employed the winter in reorganizing his troops, and dismissing homeward those Greeks whose time of service was expired. This effected, early in the spring of 330, B. C. Alexander crossed the Elburz mountains* at the pass near Tehran, called that of Dumavund, and formed his army in two divisions, employing one of them in reducing the Mardi, a poor and semi-barbarous race, who occupied a tract of country between the Elboorz range and the Caspian, while the other was destined to operate northward up the eastern shore of the Caspian against Hyrcania. With this latter went Alexander, his reason for reducing this wild country being that a body of Greek mercenaries had retired thither. Hearing, however, while his army was crossing the Elburz, that Darius was in force at no great distance, he countermarched and formed a light division with which he went in person to attack him.

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* Arbela appears to have been a city, the head-quarter town of a district.

† Arrian gives three dates, one of this battle, a second of the death of Darius, and the third of the battle with Porus. This last however is erroneous.

‡ There is a great controversy amongst the learned as to whether Hamadan or Isfahan is the Ecbatana, capital of Media, through which Darius fled, and at which Alexander made his arrangements for the Bactrian campaign. I think it not at all improbable that both bore the name, but if the resources of Darius lay in Bactria, it is very unlikely that he and Bessus should have retired by Hamadan, and the evident line of advance from Persepolis, which is near Sheeraz, was Isfahan. The Paraetaceni also lay to the right, and the site of Tabas half-way between Yezd and Mushud, would show, if we assume the flight of Darius and pursuit of Alexander to have taken this direction, that the latter attempted by that route to cut off Darius from Bactria, while his main army advanced by Isfahan. Tabas is named by Quintus Curtius as the limit of Alexander's pursuit towards Bactria prior to the reorganization of the army at Ecbatana, but by a strange confusion he places the death of Darius in this flight from Ecbatana, whereas it clearly did not occur till next season. The pursuit from Hyrcania and the Elburz mountains may, however, have taken a south-westerly direction to Tabas, so as to be that referred to by Quintus Curtius, which would leave doubtful the previous march on the same place.

The Persian king, assisted by Bessus and the chiefs of Bactria and Darangia, (Seestan) had appeared with an army towards Mushhud,† but refused to abide another battle, and fled as the Greek force approached. In this flight Darius was first deposed and made prisoner, and then slain, and Bessus assuming the royal title, fled towards Bulkh in Bactria. This was in the month of July 330 B. C. and, if Quintus Curtius is right in naming Tabas as the place of the assassination, the flight must have taken a southerly direction from near Mushhud or Abbasabad, which, as the Seestan Satrap was the ally of Bessus, is not impossible. Alexander returned, according to Arrian, with the body of Darius, and crossing the Elburz range to the river Atruk, finished the conquest of Mardia and Hyrcania, (Mazenderan and Gheelan.) This effected, he took the direct route to the country of the Arii. The capital of Aria at that time is called by Arrian Susia, probably the Hellenism of Subza or Subzawar,* Herat was not in existence, but is supposed to be on the site of the city or fort erected by Alexander afterwards to control the Arians. Alexander established a Persian governor at Susia, and returned northwards to pass into Bactria after Bessus, by the routes probably of Merv or Mymuna. The Grecian king, however, had no sooner turned his back on the Arian country, than the Persian governor revolted, and having overpowered the detachment left with him in Subzawar, retired to make head at Artakaona amongst the mountains east of Herat. This brought the Grecian army back in haste. Artakaona† is a place written six ways, but which probably will be the Greek version of Oordoo Khan, a common name. Sakhir, the capital of the Ghorians at the head of the Kashk river, is a site well suited for a stronghold of refuge, and the Oordoo Khan or Artakhan intended, will probably have been near it.

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* The pass is called in Arrian, the Caspian gates, and Ragœa is placed near it. D'Anville's map of the ancient world gives precisely the locality of Dumavund for this pass. Darius's flight cannot have taken the line of the west shore of the Caspian, so as to pass the Durband Caspian gates.

† There is much confusion in this part of Arrian's narrative He mentions the reorganization of the army and many arrangements made at Ecbatana, but leaves it to be supposed that these were operations of a day or two, and that the pursuit of Darius to Ragæ and the Caspian gates was immediately taken up. But there is a winter intervening between Alexander's march to Ecbatana and the campaign, in the course of which Darius was deposed and assassinated : this season therefore was evidently devoted to the reorganization of the army, and if Alexander did follow Darius to Ragæ in 331 B. C ; [illegible] was a mere excursion at the end of the season, not a continuance or renewal of the campaign. Mr. Thirlwall has been misled by not allowing for a winter here. He supposes that season to have been occupied in the operations near Persepolis The date given by Arrian for Darius's death, compared with that of the battle of Arbela, and the stated military, and civil arrangements made at Ecbatana, prove the manner of the campaign.

Alexander followed thither with a light force, making a rapid march of 600 stadia in two days, while the bulk of his army returned southward more leisurely, and moved down to the Pontus, or inland sea, into which the Helmund discharges itself. Artakhan was evacuated on his approach, whereupon Alexander turned southward also, and the Persian governor of the southern districts, called Zarangai or Drangæ, (Seestan,) having fled eastward to the Indus, Alexander returned again into the mountains and remained some time there, while he built the fort before-mentioned on the site of Herat to check the Arrians. Here he received the submission of the tribes of the southern districts as far as Kandahar in Arachotia,[*] but it does not appear that he went thither; on the contrary at a late period of the year 330, B. C. he made the passage over the high ridges between Herat and the Kabool valley, suffering much from cold on the march, and then at the junction of the Punjshuhur and Koh-damun rivers, in the plain of Beghram, near Charikar, he founded the city of Alexandria *apud Caucasum*, about which there has been so much dispute. Its identity with the Beghram ruins has been established in a late[†] essay of Major Rawlinson, now at Kandahar, and the whole story of Arrian confirms the site. Here Alexander wintered, and at the first opening of spring in the following year, 329 B. C., crossed the Hindoo Koosh to attack Bessus. I consider it most probable that the passage was made from Charikar by the Gorebund or Purwandura Passes, for Drapsacus, which was attacked immediately after the traverse, was evidently the present Indrab, the fortress which gave so much trouble to Chungeez Khan.

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* Dr. Thirlwall supposes this Susia to be Toos, the ruins of which hav[illegible]en traced about seventeen miles NNW. of Mushhud, but Toos would be i[illegible] Parthia, and not in Aria, as thus situated

† All the Persian poems and traditions mention *Astakhar*, as the place whence Alexander marched towards India, but the Astakhar of the Shahnama is the capital of Persia. The great Roostum was a native of Seestan.

The immediate effect of this line of operation was to drive Bessus out of the whole country between the Oxus and Hindoo Koosh, and to cut him off from retreat into Kashghur. He had fomented another insurrection at Herat, and sent 2,000 horse to support it, while Alexander was making the Huzara passage, prior to wintering in the Kabool valley; but this was defeated by the garrison left in the new city, aided by a detachment sent back, without requiring Alexander's presence. Bessus therefore on the passage of the Hindoo Koosh being effected, retired at once to the mountains of Sogdiana, Nautaka, supposed to be Karshee or Nukhshab, being the position he took up to watch the further course of events. Alexander took Bulkh and all the country south of the Oxus, and established six stations according to Quintus Curtius to guard and command the passes of the mountains. He then crossed the Oxus on skins, at a point where the river was rapid and deep, and had a sandy bottom, which is the character of all the fords about Bulkh. Bessus was betrayed and given up before Alexander reached his position at Karshee, and thereupon Alexander followed up his success by seizing Markanda, (Samarkund), and he thence continued his march, meeting with no serious opposition, to the Sir or Jaxartes, called by Arrian the Eastern Tanais. He crossed this river to punish the Scythian cavalry, who had inflicted on him some loss as they retired before him through Sogdiana. Alexander fought on the other side of the Sir a sharp cavalry action, in which he was wounded severely by an arrow in the leg, his fibula or smaller leg bone being broken. He gained the victory, however, and dislodged the enemy from a mountain supposed to be that opposite to Khojund, with a loss stated at 20,000 men.

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[*] Arrian is cited as authority for Alexander's having marched by Kandahar to Kabool, and by Bamian to Bulkh, but Arrian only says the Arachotians submitted, not that Alexander ever went into their country. His words are Ταυτα δε διαπραξαμενος προηει ως επι Βακτρα τε και Βησσον, Δραγγας τε και Δραγωγους εν τῃ παροδῳ παραϛησαμενος. Παρεϛησατο δε και τους Αραχωτους και σατραπην κατεϛησεν επ' αυτοις Μενωνα. Επηλθε δε και των Ινδων τους προσχωρους Αραχωτοις. Ξυμπαντα δε ταυτα εθνη δια χιονος δε πολλης, και ξυν απορια &c.

"Having finished these things, he set off for Bactria and Bessus, in the route having established his authority over the Drangæ and Dragogi; he also established his authority over the Arachoti, and appointed Menon their Satrap. He came then into the country of the Indians, bordering on that of the Arachoti, and all these nations he reached through much snow, and in great want of necessary supplies, and with much suffering to the troops." This shews he passed through the Huzara country north of the open plains of Seestan and Kandahar, for in crossing them to the Kabool valley even in October, his army would suffer from extreme cold. He crossed apparently by the route, and in the season, when Babur suffered so much on his return from Herat to Kabool. If the march was made in the season when there is snow at Kandahar, and by that route, the passage to Ghuzni, and especially over the mountains between Ghuzni and Kabool, must have been quite closed.

[†] I much regret never having met with this essay, and doubt not that it would have thrown light on many points which are still obscure.

Alexander remained sometime on the Jaxartes, and commenced building a city or fort near Khojund. He at the same time summoned all the tribes to a general convention to be held at Zariaspe, (Huzarasp on the Oxus,) in the coming winter; but while he was so occupied in advance, the nomade tribes of the Kizil-koom desert and Lower Jaxartes, rose on the garrisons he had left in his rear, and under Spitamenes, an active and energetic partisan, besieged Markanda. Alexander on the first news of the insurrection retraced his steps towards Markanda, reducing all the cities on his way without difficulty until he came to Cyropolis, which is probably Kesh, or Shuhur Subz, where Persian tradition fixes the birth of the great Cyrus. This siege proved difficult, for the city is described as large and populous, the walls strong and high, and the inhabitants warlike. He mastered it at length, effecting an en[illegible]nce by the river bed, during a season of drought, and then returned to secure his posts on the Jaxartes, sending a division to strengthen Markanda. While he was encamped on the banks of this river, seeking to inspire the Scythians with a dread of his power, the division of his army sent for the relief of Markanda, was defeated and utterly destroyed on the banks of the Zurafshan* river by Spitamenes. This called Alexander back to Samarkund, and after ravaging the valley of the Zurafshan, he moved to Huzarasp, where he had proposed to winter, in order to hold the convention before proclaimed, and to confirm by policy, the influence his victories had established. It was here that Clitus was slain, and that Scythians from the western Tanais (the Wolga or Don) came, and endeavoured to persuade Alexander to attempt the passage that way back to Europe; but Alexander excused himself, saying, he must first conquer India, and then would come by the route of Europe round that way to the Tanais and Huzarasp.†

Early in the spring of 328, B. C. while the snow was still on the ground, Alexander took the field again, for reduction of the cities of Sogdiana, which still held for Spitamenes. His army marched in five divisions, Alexander heading that which took the mountain road by Samarkund. Soon after the march, Huzarasp was attempted by surprise, but saved by its garrison. Spitamenes then made a gallant attack on the left division led by Cœnus, which skirted the desert, and had marched apparently for relief of the garrisons of the Jaxartes: it was met by Spitamenes while countermarching for the defence of Huzarasp, consequently on the attack of that post. Being defeated by

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* Arrian calls the river of Markanda, Polytimetus, the much-valued, Zurafshan is *gold scattering*. The description of its losing itself in the sands of the Bokhara Desert confirms the identity, if the name and other circumstances had left any doubt on the subject.

† The site of Huzarasp, no less than the similarity of name, proves it to be the Zariaspe referred to. It is on the Oxus in the advanced position suited to the convocation, and is exactly the place the Scythians of the Steppes towards the Wolga might be expected to come to, while the river being navigable gave all the desired facilities for forming a depôt. The next year's march back to Samarkund establishes the correctness of this position, and it is further confirmed by the communications held at it with the Chorasmeni, (Kharizmees.) Kheeva and Orgunj, the capitals of Kharizm, being only a few marches down the stream of the Oxus. The limits of ancient Bactria might well extend down the Oxus as far as Huzarasp.

Cœnus, Spitamenes was deserted by his followers, who hearing that Alexander himself also was approaching, cut off their chief's head, and sent it as an atonement for their own transgressions.

Being thus rid of this active enemy, Alexander had leisure to reduce the mountain forts of Soghdiana, lying between the sources of the Jaxartes and the Desert west of Samarkund; and the season being occupied in establishing posts and settling this country, he wintered again north of the Oxus at Karshee, and there received reports from all the Governors and Satraps he had left in the conquered territories.

In the spring of 327, B. C., while the snow was yet heavy on the ground, Alexander commenced his march through the mountains towards Bulkh, reducing the places that refused to submit. He was in this march much distressed for provisions, but every fort had its depôt, and the store of one of these, held by a chief named Chorienes, furnished a two months' supply to the whole army at a time when it was in great want. As the spring advanced, Alexander taking the route of Bulkh, approached the Hindoo Koosh again, and crossed it to the city he had built in the plain of Beghram. There he was met by Taxiles, an Indian chief, whose capital (Taxila) was across the Indus. This chief urged an advance in that direction, with the design of bringing to subjection a rival chief of Peucilaotis, supposed to be in the country near Peshawur. Alexander sent with this Indian chief Hephæstion, and the bulk of his army, marching them by the route of the Cophenes river. Under the Raja's guidance, Hephæstion passed without obstruction downwards, apparently by the Khyber, and having captured Peucilaotis, set himself with the aid of Taxiles, to build a bridge at Attuk. Alexander himself was determined to reduce the mountainous tract of country lying between the Cophenes and the Hindoo Koosh, and the number of rivers passed, and description of each given by Arrian, correspond exactly with what we now know to be in existence in that tract, though the names of several places and of races of people differ as might be expected.

Alexander from Beghram passed down the Punj-shushur river, and crossed the Tagao with difficulty, then reducing two cities, the second called Andaka, he came to the river Euaspla, (Alishung), where the Aspii were in arms. The enemy fled to the mountains, and Alexander followed to their stronghold, finding the capital which Arrian calls

Arigæum, deserted and in ruins. There was a very severe battle fought here, which ended in the complete defeat of the natives, and the capture of 230,000 head of cattle, remarked as of very fine breed. Thence Alexander marched against the Assaceni, passing through the territory of the Guræi, (Lughman,) and crossing the river of that name (now the Koner or Kama,) which Arrian states as rapid, and difficult of passage, because of the large round slippery stones in its bed. On the eastern banks of the Koner river, was the city of Massaga, somewhere near Pooshoot, which was captured with great difficulty; and some mercenaries of the garrison, stated to have been of Indian race, were incorporated with the Grecian army.

From Massaga, Alexander marched to Bazira, without crossing another river, shewing evidently, that Bazira must be the present Bajaor. He expected it to be surrendered without a siege, but was disappointed, and hearing that relief was coming from Ora, which is probably the present Punjkora, he marched with his main army first against that place, leaving a detachment before Bazira to watch it. Ora being reduced, the inhabitants of Bazira evacuated the city, and took refuge in the difficult post of mount Aornus, under which lay Embolima, which Alexander occupied. This mountain will probably be that to the south of Bajaor, and between it and the Kabool river. The dislodgement of the enemy proved a matter of extreme difficulty, because of the steep ascent of the mountain. Ptolemy, however, with some light troops effected and made good a lodgment on the ridge, aided by an attack from which, the rock was at last stormed and carried.

After this, Alexander marched north to Dyrta, (which is evidently the present Dhyr,) because he heard that the king of the Assaceni was making head in the upper part of the valley of the Koner, that is, in Chitral and Little Kashghur. From hence he crossed to the Indus by a route, which required the labour of his whole army to render at all passable. He arrived on the bank of that river at a place where there was a forest, from which he cut timber to make rafts and boats, with which he floated down to Attuk, where the bridge of boats had already been built for him by Hephæstion and Taxiles. In the country between the Kophenes and Indus, Nysa, the city of Bacchus, is said to be situated, from whence Alexander received a deputation. Its site has not been ascertained, though, as ivy grew there, it must have been high in the mountains.

Crossing the Indus by this bridge, Alexander went with Taxiles to Taxila, the capital of the latter, which probably was near the present Tatta, about one march from the river. Thence he prosecuted his march to the Hydaspes, now the Jihlum, on the other side of which Porus was encamped with a large Indian army. To aid the passage, Alexander sent back to the Indus for some of the boats or rafts he had built, and causing them to be brought over by land, amused Porus for some days by marching up and down with great parade, as if he was about immediately to force a passage.

Arrian tells us this occurred in the rains when the river was much swollen, and that Alexander was thinking of waiting for the cold season when the waters would subside. After some days, however, finding a favorable rock to conceal his preparations, he launched his boats and effected a passage at a place where there were several alluvial islands. Porus was then defeated and made prisoner. Arrian specifically tells us, that this battle was fought in the month Munychion, which is the last but two of the Greek year, beginning in July. April and May would therefore be the time of the year indicated, but this is not reconcilable with the fact of the rains having set in to swell the stream. The date assigned by Dr. Vincent and all later commentators, is August 327, B. C. which, supposing Alexander to have crossed the Hindoo Koosh on the first opening of the passage at the end of March, or in the beginning of April, gives evidence of a celerity of movement, and rapidity of conquest to excite our wonder.

After the defeat of Porus, Alexander captured Sangala on the Hydraotes, supposed to be near Lahore, and then marched to the Sutlej at a spot below its junction with the Hyphasis (Beas) where historians say, he built pillars or altars to mark the limit of his conquests. Apollonius Tyaneus is made by Philostratus to say, that he saw them in the first century of the Christian æra, and that a king, Phraotes, of Greek race, and who conversed freely with him in Greek, was then reigning in the Punjab, and master of the country as far west as the Kabool valley. These altars however, though sought for with much avidity, have never yet been found by modern travellers. The remonstrances of the Macedonian troops, and their refusal to march further, created the immediate necessity for Alexander's return. But preparation had antecedently been made for it by arrangements to construct a large fleet of boats on the Hydaspes or Jihlum. These were completed by the end of the rains of 327 B. C., and Alexander then commenced a march down the Punjab and banks of the Indus, in the hope of finding a ready way back to Persia by land or sea from its mouths.

On the way down, he was troubled by the spirited resistance of the Malli and Oxydracæ, the former supposed to be settled near Mooltan, and the latter a race occupying Kuchchee. In the operations against these, Alexander received a wound with an arrow in the right breast, which very nearly proved mortal, and much alarmed his faithful troops. He recovered, however, and having reduced the Sindians, made the following arrangements at Pattala, now Tatta, for return. Craterus he sent by Kuchchee and the Bolan Pass with the bulk of his army, and the heavy baggage. Nearchus with the fleet was to skirt the coast, and so make for the Persian Gulf. Alexander himself with a lightly equipped force took the route through Beloochistan, intending to keep in communication with the fleet.

This march proved the most disastrous operation in which Alexander had yet engaged; from first to last, he suffered extremely from heat, and from the want of fresh water, and the distress his army encountered is reoresented as almost beyond endurance, and the mortality in consequence was very great.

Dr. Vincent states, the march down from Nicæa on the Jihlum, where the battle with Porus was fought, to Pattala or Tatta, at the head of the Indus Delta, to have occupied nine months; if it was commenced, therefore, in October 327, it will have been July 326, B. C. before he reached that city: and so far Arrian bears out this date, for he says the Etesian winds, that is the monsoon, prevented the voyage by sea at the time of Alexander being in Sindh. Having made arrangements for establishing depôts near the sea-coast, and for digging wells to supply the fleet and his own army with fresh water at the first stages along the coast, Alexander set off on his march of return in September 326, B. C., directing Nearchus to follow as soon as the season was favorable. The circumstances of this voyage have been so accurately developed by Dr. Vincent, that it is only necessary to refer to them very shortly. Nearchus left the Indus a month after Alexander, but some time still before the monsoon had properly changed: he was in consequence compelled to make for the coast and disembark, and so consumed all his provisions by the time he reached the country of the Oritæ in Mekran. Here, however, Alexander had left a depôt under Leonatus, prior to striking off from the coast to skirt the arid desert of Gedroos. From the borders of the Oritæ to the capital of Gedroos, called by Arrian "Pura," Alexander's march was one of sixty days, with always a very scanty supply of water, and that generally brackish. Pura is probably the Bunpoor of modern maps, which is in the same longitude with the Hamoon, or sea in which the Helmund terminates. Here Alexander remained some time to refresh, and receiving a convoy from Lower Persia, renewed his march through Karmania, (Kurman,) meeting every where, as he approached the limits of civilization, both welcome and abundance. Either at or near Kurman he met Craterus, who had safely brought back the heavy baggage and bulk of the army by the Bolan Pass and by Kandahar, but by what route from Seistan, is no where mentioned.

The expedition ended by Alexander's return to Persepolis or Pasargada, near Shiraz, with a light division, while he sent Hephæstion to skirt the coast and relieve Nearchus. The united army of Alexander reached Susa about the end of February 325 B. C., just five years from the period of its march from Ecbatana in pursuit of Darius, and five and a half from the date of the victory of Gaugamela or Arbela.

It is difficult to account for the apparent facility with which Alexander carried his large armies over tracts now deemed impassable for more than caravans. We must allow something for the habit of dealing as slaves with the entire population of a city or province reduced after resistance in arms. This gave means of transport over mountains, such as are not commanded in the strategic operations of the present day. But, after making every allowance for the free command and use of the persons and properties of the entire population subdued, the traverse of the deserts would not have been possible, if in those days they had been in the same condition as they are at present found. Their existence is identified, but their dimensions were then probably much smaller, for it is consistent with the experience of modern philosophy, that sandy deserts progressively increase in size, as well through the earlier soakage of the waters, which give fertility to their borders, as by the effect of wind in carrying and depositing sand, and so producing barrenness over tracts which before owned a fertile soil. With every allowance, however, for a more favorable condition of the countries traversed than they now exhibit, we shall yet find in the marches of Alexander a celerity of movement, and a promptitude of resource in difficulties of all kinds, of which it is much to be regretted, that his historians have not given more full details for instruction at this day.

H. T. P.

Proceedings of the Asiatic Society.

(Friday Evening, 10th June, 1842.)

The Honourable H. T. Prinsep, Esq. President, in the Chair.

G. C. Cheap, Esq. proposed at the last Meeting, was ballotted for and duly elected a Member of the Society.

Ordered—That the usual communication of his election be made to Mr. Cheap, and that he be furnished with the rules of the Society for his guidance.

Library.

The following Books were presented:—

Books received for the Library of the Asiatic Society for the Meeting on the 10th June, 1842

The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science. 3rd series, vol. xix. No. 127, and vol. xx. No. 128.

List of the Members of the Royal Asiatic Society of Great Britain and Ireland. 1841, pamph.

Lassen, Zeitschrift fur die Kunde des Morgenlandes. Bd. iv. Heft. 1.

The Calcutta Literary Gleaner June, 1842. Vol. 1st, No. 4, two copies.

The Calcutta Christian Observer. New series, vol. iii. No. 30, June 1842, pamph.

Journal des Savants. Paris, Octobre 1841.

Transactions of the Zoological Society of London, 1841. Vol. ii. Part 5th.

Proceedings of the Zoological Society of London, 1840. Part 8th.

The Annals and Magazine of Natural History. Jan. 1842, No. 52, vol. xiii. pamph.

Yarrell's History of British Birds. London, 1841. Vol. iii. Part 28th, pamph.

Macpherson's Report upon the Khonds of the Districts of Ganjam and Cuttack. Calcutta, 1842.

Report on the Settlement of the District of Seharanpore, compiled by E. Thornton. October 1810.

Lardner's Cabinet Cyclopœdia, Natural Philosophy, London, 1841. Vol. 1st.

Wilson's Introduction to the Grammar of the Sanscrit Language. London, 1841, 1 vol.

Bulletin de la Société de Géographie. 3rd Série. Paris, 1841, Tome xv.

Read the following report submitted by the Librarian, respecting the arrangement of Antiquities in the Museum:—

To H. TORRENS, Esq.
Secretary, Asiatic Society.

SIR,

I beg to submit to the Society the following report respecting the arrangement of the antiquities.

During the last three months I have had charge of this department of the Museum, and it has been my constant endeavour to identify the specimens, and place the collections in order.

The accompanying list which is to form the first part of the Catalogue, contains the arrangement and description of the antiquities and idols in metal and wood, and of the smaller ones in stone.

However, as little had been done to preserve the identity of the antiquities, no regular register kept, specifying the particulars, and giving a detailed description of the respective donations, in order to enable the Society to judge on the correctness of the catalogue, I hope, they will excuse me, if I trouble them with a statement of the reasons, which guided me respecting the identifying of the specimens.

I. Nos. 1—5. Five Egyptian idols, four of wood, and one of porcelain, presented by Lieut. Young, December, 1837, ascertained by the name of the donor, being written upon them.

Nos. 6--15. As. Res. Vol. *XIV*. Appd. p. 3. is mentioned a small collection of metal and porcelain images, presented by Capt. Bidwell, and as there is no other collection of this kind, we must suppose this to be the same that is mentioned in the Researches.

II. No. 16. A copper figure dug up near Bushire, donor Capt. J. Hennel, As. Journal, Vol. v. p. 241, identified by a drawing, given in the Journal.

III. Nos. 17—23. Seven brass and copper Images, presented by R. Home, Esq. As. Res. Vol. *XII*. Appd p. 23.

Among the number of these Images, a Sesha Naga is mentioned, resting on a tortoise, and as there is only one of that peculiar situation in the collection, it undoubtedly is the same. On examining this figure, I discovered in the inside of the pedestal a cypher, made with white oil colour, and by this means I found out the other specimens, which had on the very same place, cyphers of the same colour, and the same hand writing.

IV. Nos. 24—38. Fifteen brass Images from Patna and Allahabad, presented by Dr. Tytler, As. Res. Vol. *XIV*. Appd. p. 3; they had labels upon them, containing the name of the donor, and of the locality.

All of them refer to Shiva, and eight of them have a special allusion to the worshipping of the Lingam in different forms, generally Shiva, or Parvati, or both of them adoring this symbol. I must not omit mentioning, that one of them, a Shiva Lingam, worshipped by Gonesha, Nandi, Kartika, and Sesha Naga, has the crescent and the sun added, as so many more symbols of this worship.

That it is Shiva, however, who is represented in those images, and not another deity, as some at first would suppose, is evident from the trident and crescent being in all the images, though sometimes in a shape and in places which are not apparent at the first glance. These representations are singular for the number of their attributes and the rudeness of the style of the workmanship. No others in the collection exhibit the same rudeness of figure; for the different parts of the body can hardly be distinguished. From this, some would suppose them to be of great antiquity; but all these figures may be regarded as symbols which are formed not in a barbarous, but in a civilised age, and their vagueness and rudeness are designed to suggest to the mind of the worshipper, something indefinite and mysterious in the image which he adores.

V. Nos. 31—67. 1. There are mentioned in the Asiatic Journal, Vol. *XVII*, p. 368, three brass Images, Lokanatha, Durga-Singhbahni, and Goutamah from Nepaul, presented by S. Bramley, Esq. Two of them bear the name of the donor, and the third, Lokanatha, though the name is wanting, has such a striking resemblance to the Goutamah, that we may safely declare it to be the one mentioned in the Journal. The second Goutamah whom I have put together with them, has also so many characteristics in common, that had there been more than three mentioned in the Journal, I should have felt myself justified in assigning it to the same donor.

2. Nos 48, 49, 50. Three ivory idols. I found no references to them in any periodical of the Society. They are evidently made by the same artist. On one of them "Nepâl" is written with a pencil, and they are moreover so like those just mentioned, that no doubt of their coming from the same country, can arise.

3. The fourteen images under numbers 53-66, representations of Hindoo deities, workmanship, ornaments, &c. being of the same style, are evidently all from the same place, which supposition is confirmed by the labels annexed to them, which are written by the same hand: but neither the name of the donor nor the locality is written. There are seven other Images without labels; but they so strikingly resemble in every particular those just mentioned, that we may assign to them the same country.

This, I think, is Nepâl, for the following reasons :—

a. All of them exhibit a very extraordinary similarity with those presented by Mr. Bramley. The Durga Singhbahni, above mentioned, for instance, corresponds in the principal characteristics with a Durga of this group in the form of Durga Mohishmordini ; we observe the same dress, the same ornaments, the same kind of pedestal Though the head-dress in both is somewhat different, yet again the shape of the crowns, with all their particularities, is nearly the same, and in many of the images this similarity is still more striking. To this conclusion we are also led by the similarity which is seen in the formation of the head and expression of the countenance, which is seldom found but among people of the same nation, nay, I should almost say, of the same tribe.

b. The strongest confirmation, however, is derived from the workmanship. It is true, this may be under certain circumstances identic, and the artists still belong to different countries, *if* for instance they be of the same school. There is, however, nothing in Hindooism, which suggests the idea of such schools. The sects are too much in enmity with each other, the intercourse of the various countries too limited, and the artists of one place too closely adhering to their old established traditions, to authorise the supposition of a school of art, flourishing at different places. If there be a general coincidence in the workmanship of several specimens of Indian art, we may therefore infer on the identity of the country from which they come. Each of these conclusions require some caution, but if all the circumstances from which they are derived, combine, there can certainly be no occasion for doubt, and, on the whole, the principle, that the correspondence in minute and accidental particularities we may observe between a number of specimens of art, constitutes a sufficient reason to identify them in one way or another, according to the circumstances, is certainly well-founded.

c. Another confirmation is their likeness to the three ivory idols, above mentioned. A most remarkable coincidence is especially exhibited between the ivory Durga in the form of Tara, with another of ten arms, as behind the shoulders of both the same standards, with the same emblems upon them, may be observed.

As. Res. Vol. *XV*. Appd. p. 16, is recorded, that Lieut. C. P. Boileau from Nepaul, presented a great variety of brass images to the Society, so that we may assign the images, just named, to him, as there is no other number of images which bears so evident signs of composing one and the same collection, or which would prevent us from ascribing them to Nepaul.

VI. As. Res. Vol *XVI*. Appd. p. 12, a donation of Images from Arracan is mentioned, consisting of the following specimens :—

1. A wooden model of Gotama's Temple.
2. Brass model of a Temple, used in the worship of Gotama.
3. A tin statute of Buddha, affording a correct model of some of the Arracan Temples.
4. Antient brass model of a Temple, containing four images of Buddha with Nags or Serpents.
5. A brass Statue of Gotama, with an attendant in an erect posture.
6. A wooden figure of Gotama, gilt and highly ornamented.
7. A ditto ditto, plain and gilt.

All these specimens were found with labels, presenting the name of the donor and locality. Further,

8. A wooden figure of Gotama, plain and gilt.
9. Two wooden female devotees of Gotama.
10. A wooden image of a female, called wife of Gotama.
11. Thumb of a large image of Gotama, made of solid stone.
12. A white marble statue of Gotama.
13. An iron figure of Gotama, gilt.

As these specimens on examination were found unique, no doubt could of course arise about their identity.

We find at the same place mentioned the following donations by the same Gentleman :—

14. A copper figure of Gotama, highly ornamented.
15. A brass ditto, gilt.
16. A ditto ditto, highly ornamented, and holding a pot with offerings.

17. Four brass statues of Gotama, crowned, and holding offerings.
18 Ten brass figures of Gotama.
19. A stone figure of Gotama.

The first seven statues were ascertained without difficulty, the short description given of them, being sufficient to discern them among the number of others.

Of the ten Statues of Buddha, I recognise eight from the number 75 to 82 in the list, for the following reasons:—

Three of them are much similar in their ornaments, the shape of their pedestals to those under numbers 71—74. A striking similarity between them is the manner in which the attendants are placed on the corners of the pedestals, and all of them have the same forward bending position. This circumstance alone suffices for vindicating the placing of them under the same group; for though the same ideal of the representation of Buddha, may be observed with Buddhists of different countries, yet it is obvious from even a small collection of specimens of Buddhist art, made at different places, that there is a marked difference between them in little particularities, and such a correspondence being found in a number of specimens, we may safely attribute them to the same country. Moreover, could there be any doubt of this, the similarity in the forms of the face would remove it. If the identity of these three images be granted, we cannot refuse to claim the same decision for the remaining five; for though the attendants do not accompany them, and the pedestals differ, still the national characteristics are too prominent to allow us forming a different opinion. The same holds good with regard to the stone figure.

In concluding this report I beg to observe, that many of the Members of the Society undoubtedly have a recollection of the circumstances under which some of the antiquities were laid before the Society, and with regard to those antiquities which are not yet identified, especially the statues and sculptures, I would request them to favour me with such information, as they are able to give about them.

I have the honour to be,
Sir,
Your obedient Servant,
E. Roer.

3rd June, 1842.

I —*Antiquities which have been identified.*

A.—*Egyptian.*

1. Figure of wood.
2. Ditto ditto.
3. Ditto of Porcelain.
4. A Head made of clay.
5. A Head made of wood.

Presented by Lieut. Young, (see Jour. As. Soc. Vol. VI. page 987.)

6 to 11. Porcelain figures, with Hieroglyphic characters.
12. A figure of metal, representing Isis with a Horace on her lap.
13. A ditto ditto of wood.
14. A figure of metal.

Presented by Capt. Bidwell, (see As. Researches, Vol. XIV. Appendix p. 3.)

15. A beetle made of plaister, with Hieroglyphic characters.

B.—*Persian.*

16. A copper figure, dug up near Bushire.

Presented by Capt. J. Hennel, (see Jour. As. Soc. Vol. V. p. 241.)

C.—*Indian.*

a. From Patna or Allahabad.

17. A brass Sésha resting on the tortoise.
18. A copper Bhavani, with a lion's head, canopied.
19. A copper figure of Parvati.
20. A ditto ditto.
21. A copper figure of Ganesa.
22. A copper figure of the Infant Crishná.
23. Figure of Buddha.

Presented by R. Home, Esq. (see As. Researches, Vol. XII. Appendix p. 23.)

24. A brass figure of Siva with five heads, from Allahabad.
25. Four brass figures of Bhairava, adoring the Lingam.
26. A brass figure of Shiva, from Allahabad.
27. Two brass figures of Shiva, adoring the Lingam.
28. One brass figure of Shiva, from Allahabad.
29. A brass figure of Kali, attended by her Lions, from Allahabad.
30. A brass figure of Shiva.
30. *a.* A brass figure of Shiva, from Allahabad.
31. A brass figure of Shiva, adoring the Lingam, from Allahabad.
32. Two brass figures of Shiva, adoring the Lingam.
33. One brass figure of Parvati, adoring the Lingam.
34. Ganesa and Kartika, adoring the Lingam.
35. Brass figures of Siva and Parvati, from Patna.
36. A brass figure of Parvati, from Allahabad.
37. A brass figure of Parvati, from Allahabad.
38. A brass Arrotee, from Allahabad.

Presented by Dr. R. Tytler, (see As. Res. Vol. XIV. Appendix p. 3.)

D.—*Antiquities from Nepal.*

1.—BUDDHIST.

39. A copper figure of Gotamah, holding offerings.
40. A copper figure of Gotamah, holding offerings.

Presented by S. Bramley, Esq.

41. A brass Budhistical figure.

————*Donor ?*

42. A brass Buddhist figure.
43. A brass female Buddhist figure.

Presented by Lieut. J. P. Boileau, (see As. Researches, Vol. XII. Appendix p. 16.)

2.—HINDU.

44. A copper figure of Lokanatha.

Presented by S. Bramley, Esq. (As. Jour. Vol. II. p. 368.)

45. A brass figure of Lokanatha.
46. A ditto ditto.
47. A wooden figure of Lokanatha.

Presented by Lieut. J. P. Boileau, (As. Res. Vol. XIII. Appendix p. 16.)

48. An ivory figure of Durga in the form of Tara, (4 arms with the skull of a giant in one hand, and surrounded with the necklaces of Human Skulls.)

———— *Donor ?*

49. An ivory figure of Baráha Avatar, (with the attributes of Tara as above specified.)

———— *Donor ?*

50. An ivory figure of Ganésa.

———— *Donor ?*

51. A brass figure of Tara.

Presented by Lieut. J. P. Boileau, (see As. Res. Vol. XIII. Appendix p. 16.)

52. A brass figure of Durga Mohish Mordinee, (with eight hands.)
53. A ditto ditto of Garuda.
53. *a*. A ditto ditto of Shiva.
54. A brass figure of the first incarnation of Shiva, "Matseea Avatar."
55. A brass figure of the second incarnation of Shiva, "Koorma Avatar."
56. A ditto ditto of the third incarnation of Shiva, "Borahá Avatar."
57 A ditto ditto of the fourth incarnation of Shiva, "Nursingha Avatar."
58. A ditto ditto of the fifth incarnation of Shiva, "Vamana Avatar."
59. A ditto ditto of the eighth incarnation of Shiva, "Sree Krishna Avatar."
60. A ditto ditto of the Kalika Avatar.
61. A brass figure of a Vishnú, with four arms.
62. A ditto ditto of Narain and his Spouse "Luksmee."
63. Three brass figures, Krishna with two female attendants.
64. Three brass figures, Ram, Lokhana, and Sitta Dévi.
65. A brass figure.
66. A ditto ditto of the goddess Kalee.

E.—*From Arracan.*

1. BUDDHIST.

67. A copper figure of Gotamah, highly ornamented.
68. An iron figure of Gotamah, gilt.
69. A brass figure of Gotamah, gilt.
70. A ditto ditto highly ornamented, and holding a pot with offerings.
71 to 74. Brass statues of Gotamah, crowned and holding offerings.
75 to 82. Brass figures of Buddha.
83. A brass statue of Gotamah, with an attendant in an erect posture.

Presented by Dr. R. Tytler, (see As. Researches, Vol. XVI. Appendix p. 12.)

84. A stone figure of Gotamah.

——— *Donor?*

85. A brass statue of Gotamah, with a crown, and ornamented.
86. A wooden figure of Gotamah, gilt and highly ornamented.
87. A wooden figure of Gotamah, plain and gilt.
88. A wooden figure of Gotamah, plain and gilt.
89 to 90. Two wooden female Devotees of Gotamah.
91. Ancient brass model of a Temple, containing four images of Buddha, with Nagas, or Serpents, over the entrance.
92. Thumb of a large image of Gotamah, made of a solid stone.
93. A tile representing the foot of Gotamah, impressed with the figures of Buddha.
94. A wooden image of a female, called the wife of Gotamah.
95. A wooden model of Gotamah's Temple.
96. A brass model of an Arracan Temple, used in the worship of Gotamah.
97. A statute of Buddha, affording a correct model of some of the Arracan Temples.
98. A Siva Lingam, procured in a Temple at Keykeramdong.
99. A white marble statue of Buddha. *Donor,* Dr. R. Tytler (*see As. Researches, Vol. XVI. Appendix, p.* 12.)
101 to 113. A set of Arracanese Griffin Weights of brass. *Donor,* Captain Bogle, (*see As. Journal, Vol. VI. p.* 987.)
114,115,116. Figures of Buddha, gilt. *Donor?*
117. An earthen sculpture of Buddha, with two attendants, and Sanscrit Inscription, from Tagoung, about 100 miles from Ava.
118. An earthen sculpture of Buddha, with Sanscrit Inscription.

Presented by Captain Hannay, (see As. Journal, vol. V. p. 126.)

119. An earthen sculpture of Buddha, with Sanscrit Inscription.

Presented by Prince Alakara, (see Journal As. Society, Vol. X. p.—)

120. An earthen sculpture of Buddha, with Sanscrit Inscription. *Donor?*
121,122. Earthen sculptures of Buddha, with Sanscrit Inscription, gilt. ——— *Donor?*
123,124. Marble statues from Pagahna Mew, a town in the Birman Empire, situated on the East side of the Irrawaddy River. Lat. 21° 9′ N. Long. 94° 35′ E.

Presented by Captain Ross, (see As. Researches, Vol. XVI. Appendix p. 12.)

125. A stone Lingam with Sculptures.

Presented by Dr. R. Tytler, (see As. Researches, Vol. XV. Appendix p. 36.)

F.—*From Java.*

126 to 201. A brass figure, supposed to be "Kartika" seated on a Peacock, with a Lion's mouth, and holding a spear in his right hand.
127 to 202. A brass figure, sitting with crossed legs on a state chair.

II.—*Idols and Antiquities not identified with regard to their Donors and Localities.*

1.—BUDDHIST.

126. A brass figure of Buddha.
127. A wooden model of Buddha.
128, 129. Copper figures of Buddha.
130. A brass figure of ditto.
131,132. Copper figures of ditto.
133,134,135. Copper figures of Buddhas holding offerings.
136. A small copper bell in the shape of Gotamah.
137,138. Copper Budhistical figures.
139 to 142. D. D. ?
143. *a*. A copper Buddhist figure with ten hands, gilt.
143. *b*. A copper mould and lead cast of five Buddha figures.

2.—HINDU.

144. A brass figure of Siva and Parvati.
145,146. Copper figures of Parvati.
147. A brass figure of Siva, with four hands.
148. A copper figure of Siva, in a sitting posture.
149. A brass figure of Durga Mohish Mordini, with eight hands.
150. A brass figure of Durga, with eight hands, destroying the Asura.
151, 152. Copper figures of Durga Singh Bhani.
153. A copper figure of Gonesha, sitting on a rat.
154. A brass figure of a Devotee, being the representation of the Lingam worship.
155. A copper figure of Siva, with four hands.
156. A brass figure of Vishnu.
157. A copper Bhavani, with a Lion's head, and canopied by Sésha Naga.
158. A copper figure of Lokshmi.
159. A ditto ditto.
160. A brass figure of Vishnu.
161. A copper Kalika Avatar, mounted on a horse.
162. A ditto ditto.
163,164. Brass figures of Krishna.
165. A copper figure of young Krishna.
166. A copper figure of infant ditto.
167. A copper figure of Krishna, standing under a tree.
168. A copper figure of Radha.
169. A brass figure of —— ?
170. A ditto ditto of —— ?
171. A brass figure of a Devotee holding offerings.
172. A copper figure of Hanúman.
173. A ditto ditto.
174. A brass figure of Hanúman on one side, and of a Devotee, on the other.

175. A brass figure of a Munee or Devotee.
176. A ditto ditto of a Devotee.
177. A ditto ditto of a Female.
178 A brass figure of a Female under an arch.
179. A ditto ditto canopied by Naga.
180. A brass figure of a Devotee.
181 A copper figure —?
182. A brass figure holding a snake with both hands.
183. A brass Arrotee, containing five oil burners, and the figures of two men and a female.
184. A copper cast of a Peacock.
185 to 188. Earthen casts of figures, with Sanscrit Inscriptions.
189,190. Copper Snakes.
191. Copper Snake, with five mouths to a head.
192. A copper Bull and a figure, canopied by Naga.
193. A brass Bench.
194,195. Copper moulds for casting the Lingam.
196,197. Brass moulds for ditto ditto.
198. A copper head of a Human Figure.
199. A procelain figure of an Ape.
200. A brass figure of a Female Dancer.

Read letter from B. H. Hodgson, Esq. Resident of Nipal, with a specimen of the style in which Mr. F. Howard, the celebrated illustrator of Capt. Harris' African Beasts, proposed to bring out his mammals and birds of Nipal. There are about 100 quadrupeds which Mr. Howard will give for No. 50 in alternate monthly numbers of twenty plates, each No. to cost Rs. 10.

Read a further letter from the same gentleman, enquiring if the Tibetan mammals and birds sent by him through various channels (specified) had been received, and advising the dispatch of thirty-one drawings for exhibition at the Society's Meeting, and for ultimate transmission to London, "so that in India and England the authorities and public may resert to their promise to support the work by subscription."

The drawings referred to were exhibited; and the subject, it was remarked by the Secretary, would have the notice it deserved in an early number of the Journal.

The Secretary exhibited some specimens of *Ningpho China*, consisting of cups, sugar pots, flower vases, intended to be hung on the walls of a room; imperial pattern plates, and basons, Chinese scales, and other articles presented by Lieut. J. Brockman, H. M. 50th Regiment; some of these articles, although of a trifling nature, were valuable as curiosities.

Read a letter from Mr. D. Ross, offering for the acceptance of the Society an old mineral glass case.

Read letter from the Honorary Secretary of the Royal Asiatic Society, London, of the 4th December 1841, conveying thanks of the Royal Society for five numbers (109 to 113) of the Journal of the Asiatic Society of Bengal.

Read the following letter from J. H. Batten, Esq., of 8th February, 1842 :—

My dear Torrens, *Almorah, February* 8, 1842.

Having returned to Almorah, I lost no time in sending off an instalment of the Herbert MSS. to the Asiatic Society, and accordingly on 6th instant I despatched by dâk to your address, a packet containing two neatly written vols. which can at once be printed off. These vols. contain a Journal of Herbert's visit to the lower ranges of Sirmoor, and the low country and hills about Bark and Roopur, below the Soobathoo mountains, to the Terrai east of the Jumna, belonging to the Suharunpore Zillah, to the Dehra Doon, and thence crossing the Ganges along the edge of the Bijnore, and Moradabad and Pilibheet Terrai, to that of Kumaon, and to Bhamouree Pass, and thence by the Bheemtal route to Almorah. Captain Herbert stayed at Almorah a whole summer, and recorded observations. Thence his Journal shews his tour in a NNE. direction towards the Juwakee Pass, (Oonta Dhoora,) and the Snowy range from which flows the Goree river, one of the main feeders of the Goggra river. Before reaching Melum, Herbert fell ill, and his Journal ends.

I have three other vols. of Manuscript. These are all badly written, and parts of them are very obscure. One of the vols. is written topsy-turvily, *i. e.* one set of observations are recorded on one side of a page, and another set on the other, and large *lacunæ* intervene. Luckily this volume relates to Kumaon, and British Gurhwal, tracts with which I am intimately acquainted, and my local knowledge enables me to decypher the names of places, and connect the threads of the narrative. I assure you that nobody at Calcutta can possibly interpret the volume in question. I therefore, propose to edit it myself, only asking time, say, to the close of the rains, for the work. James Prinsep gave up the task in despair, and I would not keep the vol. in question for a day, if I thought that his successor in Calcutta could really make any thing out of the MS. This vol. also contains Captain Manson's continuation and completion of the Journal which Herbert discontinued from illness, and the tale is thus carried on from where Herbert stopped, to Melum and Oonta Dhoora Pass, (a highly interesting tract which I have myself visited,) and back over the hills to Almorah. This part can be separately transcribed by me now, (*i. e.* before the rains,) and sent to the Society. In its present state I defy any one, who has not been at every spot named, to decypher the words, and to fill up the gaps caused by moths and white ants.

The 2nd vol. contains a Journal by Capt. Manson, (Herbert's then Assistant, now Commissioner with Bajee Rao,) of a tour from Almorah to the outposts at Petorah Gurh and Lohooghat, and thence through the hills nearest the plains, to Bheemtal. The writing in this vol. has become very obscure from time and the ravages of insects, but I hope, with the aid of my map and local knowledge, to decypher the whole of this little narrative. In this vol. as in the others, there are double sets of numbers for the

2274
rock specimens, thus: No. 160—Greenish white quartzose rock, &c. &c.
No. 2275
161. Greyish rock approaching to porphyritic.

The 3rd vol. is, I believe, first in order of time, but the dates of months are for the most part given, and not those of years. Prinsep's note makes the year of this Journal to be 1826, and this would appear to be correct. It begins with *Chilkeea*, the mart for hill productions between the Kumaon Terrai and Casheepoor; thence the Journal describes Herbert's tour up the Kosilla river into the Kumaon Hills viâ Dhikkolee and Chokoom as far as Okuldoonga, where he left the river and ascended to Tarket. It then shews his return to Chilkeea, and passage through the Terrai to Haldooa and Casheepoor, and thence along the edge of the forest in a westerly direction to Juspoor, Burrapoora, Kadirkote, and Nujeebabad to Nagul, where he crosses the Ganges, and marches by Bhogpoor to Hurdwar, and thence through the lower hills and Doon to Dhera. At Hurdwar, Capt. Herbert makes the following note: "I begin here to number my second thousand with the printed Nos. from 1," but in all this vol. there are double numbers, thus :—

$$\left.\begin{matrix}77.4\\78.5\\79.6\\80.7\end{matrix}\right\}$$ rolled specimens, chiefly hornblendic sent to Dehra.

The larger numbers representing, it would seem, the general series; the smaller, the series obtained at any particular spot. From Dehra, Herbert made excursions to Sunsur-Dhara, the celebrated dripping rock, and Col. Young's house on the hills, called "the Potatoe Garden," now a part of the great station of Mussooree. His geological observations here are very full, as are those in the range near Hurdwar. At Dehra he examined Mr. Shore's well, and describes its strata to the depth of 221½ feet. He afterwards describes his march through the Doon and across the Jumna to *Kalsee*, where he regularly enters the hills. He thence marches through Jounsar, Joobul, &c. by a circuitous route to the Burin or Brooang Pass, (the Borendo of the Simla folk,) thence down the Pabur river to the Tonse, and Jumna countries, and to Dehra Doon by the Aglar valley and over Mussooree range. From Dehra Doon to Suharunpoor, Meeruth, Moradabad, Ganges Ghât, and down the river to Calcutta, and on his way down he narrowly escaped drowning at Colgong. In this vol. there are mention of 379 specimens, and Herbert in a note written in July 1827, (at Almorah I believe,) says, that these specimens were left at Moradabad, and had by an accident, become very much damaged in their envelopes. He records the shape of the labels in this series (viz. the 2nd 1000) as, and he notes the doubtful, loose and remaining numbers.

The country described in this volume has been subsequently examined by numerous travellers, as it is that chiefly visited from Simla and Mussooree, and I do not think that anything very novel will be brought to light by the Journal:— but, if it can give a clue to the *labels* and *specimens* at Calcutta, you will think it valuable, and I therefore propose to despatch this vol. to-morrow to your address. Allusions in it are frequent, I see, to places in Kumaon, as Powree; at Sreenuggur Dheeanneekot near Almorah; Jilmilputteen near Kedarnath; Punnae on the Aluknunda, noted for its curious greywacke and also metalliferous talcose rocks; Dheenpoor, the site of some large copper mines in this province, &c. This fact shews that Herbert had visited the Province, before the period of the Journal which I propose to edit. Yet, I have never seen any record of his tour to Sreenuggur, Kedarnath, &c., that is of his first visit to Kumaon, and that part of Gurhwal which is attached to this province, and I should like much to discover some Journal of the tour in question. Mr. Piddington will find the volume of MS. which I propose to send to-morrow, less kakographic and more easy to decypher than the volume which I retain, (there being no breaks [illegible] and no great admixture of other matter with the narrative,) moreover, numbers of people, and among them my friend Pratt, know the country described. It is a great pity that Dr. McClelland confined (no fault of his though) his observations in Kumaon to the immediate neighbourhood of Lohooghat and Petora. Had he examined the country South-West and North of Almorah, he would have been able to edit Herbert's Kumaon volume, and to elucidate Manson's mysterious pothooks. As it is, you must kindly beg the Asiatic Society to be thankful for the MSS. already sent, and the MS. promised by to-morrow's dâk, and to await with patience (for I have not much leisure,) my edition of Herbert and Manson's Kumaon Journal, which I will endeavour to make as luminous as possible.

Believe me to remain,
My dear Torrens,
Yours very sincerely,
J. H. BATTEN.

The letter having been read, it was proposed by the Lord Bishop, seconded by the President,—That the thanks of the Society be voted to Mr. BATTEN for the valuable services rendered by him in the recovery and transmission of the late Captain HERBERT's manuscripts, and that the acknowledgments of the Society be tendered to Mr. BATTEN for his offer of editing the late Captain HERBERT's and Major MANSON's Journal in Kumaoon.

Read the following report submitted by the Curator of the Museum:—*

SIR,

Since my last Report to the Society, the following donations of Zoological specimens have been received for the Museum.

From Dr. Wallich, a very fine specimen of the true *Zibet* of Buffon, or *Viverra Zibetha* of Linnæus, being a species of rare occurrence in European Museums, indeed I only know of one specimen which is in the British Museum, for the *Tanggalung* of the Malays, regarded as Buffon's Zibet by the brothers Cuvier, is quite a different animal, which has since been termed *V. tanggalunga* by Mr. Gray: the present species is the *V. melanura* of Mr. Hodgson, and an interesting notice of its habits, with a very recognisable figure, occurs in Williamson's 'Oriental Scenery'; there is also a figure and notice of this species in the 1st No. of Dr. McClelland's 'Journal of Natural History.'

Likewise a female specimen of *Parodoxurus typus*, which has been added to the collection of stuffed mammalia.

In the class of Birds, I have the pleasure to record the donation, from Government, of a beautiful recent specimen of *Tragopan satyrus*, which has been mounted.

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* This Report should have been published with the "Proceedings of the Asiatic Society," at p. 274, and have preceded the Report given at p. 444 *et. seq.*—*Cur. As. Soc.*

From W. Masters, Esq. a recent Chinese Lory *(Lorius Sinensis)*.

From R. W. G. Frith, Esq. through Mr. Hampton, mounted specimens of the following species of Birds.

Athene Brodiei: Noctua Brodiei, Burton, *P. Z. S.*, 1835, 152, seu *N. tubiger*, Hodgson, *As. Res.* XIX, 175, bearing date 1836.

Garrulæ leucogenys, Nobis: being the eighteenth species of this genus with which I am now acquainted from Northern India. This generic title holds precedence of *Crateropus*, Swainson, and *Ianthocincla*, Gould, applied to the same group, certain species of which have been referred to *Cinclosoma* by Mr. Vigors, and others by Mr. Hodgson. I have elsewhere endeavoured to reduce the synonyms of the various members of this genus, and have prepared descriptions of the present and another new species, for which *vide p.* 180, *ante.**

Francolinus vulgaris.

Fr. Pondicerianus: Tetrao Pondicerianus, Gmelin; *Perdix orientalis*, Latham, but not of Horsfield. A figure and interesting notice of the habits of this species have been published in the 'Bengal Sporting Magazine,' for October, 1810.

Fr. gularis: Perdix gularis, Tem: figured as the *Chicore*, in the 'Bengal Sporting Magazine' for September, 1839, but which must not be confounded with the true Chicore *(Perdix Chukar)* of the Himalaya.

Ortygis, allied to *Hemipodius atrogularis*, Eyton, *P. Z. S.*, 1839,107, and scarcely less so to *O. pugnax* and *O. taigoor*, *all these species* having a black throat and fore-neck in the mature male, and which is broader in the present species than in the two latter: from these it is readily enough distinguished by the predominance of black on the upper parts, the more strongly marked large oval spots of this colour on the wing-coverts, and the hue of the belly which is merely tinged with rufous; size intermediate. On some future occasion, I hope to do something towards elucidating the Quails, dwarf Partridges, and *Ortyges* of India, which at present are a most perplexing group, notwithstanding the exertions of Col. Sykes, and of subsequent investigators, who as yet have but very partially analysed the numerous species.†

Of the foregoing six species of birds presented by Mr. Frith to the Society, four are new to their Museum; viz. the tiny Owl, the *Crateropus*, the Wood Partridge, and the *Ortygis*.

Numerous specimens of birds have also been added to our collection, procured in the bazaar, among which it will be sufficient to notice a few of the more interesting.

Caprimulgus macrourus, Horsfield, *Lin. Trans.* XIII, 142. A very handsome male. We before possessed specimens of what appear to me to be the female of this speces, and which, if so, are remarkable for the pale colour predominating much more than in the other sex.‡

Tringa platyrhyncka, Temminck. A male in winter plumage; one in summer garb, from the old China collection, having been already in the Museum. The only additional species of this genus, which I have hitherto met with, are—*Tr. subarquata* which is not rare, and *Tr. minuta*, which is exceedingly abundant.

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* I have since become acquainted with several additional species, which I shall describe in a more elaborate monagraph of the genus.—*Cur. As. Soc.*

† I have since prepared the analysis above mentioned, which will appear in a subsequent *Report:* the bird above noticed is Mr. Eyton's *atrogularis.—Ibid.*

‡ This appears to be common in Nepâl.—*Ibid.*

Recurvirostra Avocetta : fine specimens.

Botaurus stellaris. The European Bittern, a handsome female.

Pluvianus cinereus, Nobis; being the sixth Indian species of this genus with which I am acquainted: length of a female 14 inches, by 2½ feet in extent; wing from bend 9½ inches, and tail 4½ inches; bill to forehead 1½ inch, and bare part of tibia the same; tarse 3 inches. Irides dilute red, with a cast of brown; orbital skin, small frontal lobes, basal three-fifths of the bill, and the legs, bright yellow; the rest of the bill black, as are also the claws. General colour of the upper parts pale greyish-brown, the head, neck, and breast, pure light grey, passing into black on the lower part of the breast, which terminates abruptly, contrasting with the white belly; primaries, their coverts, and the winglet, black; the secondaries and their coverts chiefly white, and the tertiaries concolorous with the back: upper tail-coverts white, slightly tinged with brownish; and tail pure white, having a black subterminal band, broad on its medial feathers, nearly obsolete on the penultimate, and quite so on the outermost. This species is new to the Museum, and I have seen but this one specimen.

Rallus gularis, Horsfield. Beautiful specimens.

Phalacrocorax pygmæus, Auct.

Rhynchea picta. I merely notice this handsome species, a fine series of which has been put up, to remark that an affinity which I long ago detected and commented upon, between this genus and the American *Heliornis*, is strikingly manifested by the living *Rhynchea.* The style of colouring and markings correspond, and the American genus is styled *Heliornis* (or Sun Bird), from its habit of spreading out the wings and tail, upon surprise, and so forming with them a sort of radiated disk, whereon the elegant markings are beautifully displayed. The same habit is observable in *Rhynchea*, which thus shews off its spotted markings to the admiration of the beholder, menacing the while with a hissing sound and neck contracted, when suddenly, seizing a favourable opportunity, it darts away upon the wing. Mr. Gray (in *P. Z. S.*, 1831, 62,) has attempted to define two alleged species of Indian *Rhynchea* by the names *Picta* and *Capensis*, the former only of which he had himself seen from Africa as well as from India and China; but he refers to Savigny's figure of *Rh. Capensis*, in the *Oiseaux d'Egypte*, as furnishing a faithful representation of the other. Should they be different, however, the attempted definitions need to be rendered more intelligible, as neither comparison of them with specimens, nor of the latter with Savigny's figure, has enabled me to decide to which the Bengal bird should be referred, and certainly the considerable number which I have seen and examined of this latter were all of the same species. Among a number of African and Indian specimens of birds identical in species which were exhibited by Col. Sykes before the Zoological Society, as noticed in *P. Z. S.* 1835, 62, were examples of a *Rhynchea* styled *Capensis*, Stephens.

In the class of Reptiles, a specimen of the *Python Tigris*, fifteen feet in length, has been purchased alive and been killed; its skin has been mounted, a number of preparations made of its viscera, and the skeleton is now in process of being cleaned. A considerable number of other skeletons, chiefly of birds, have also been laid by to be set up as opportunity will permit of it.

Mr. Frith's donation comprised, in addition to the birds which have been mentioned, a few specimens of insects, together with some pupa-envelopes constructed of bits of plant-stems, though by what species I am unacquainted.

The following are the dimensions of the magnificent Gaour of which the skin, prepared for being set up in our Museum, is now in progress of transmission from Chyebassa, as already noticed by the Secretary. They were taken by Lieut. Tickell from the recent animal, and I annex a copy of the figure which he has kindly supplied me with, in order to enable our taxidermists the better to imitate the form of the living beast in the stuffed specimen.

	Feet.	*Inch.*
A, B, a string passed along the back to root of tail,	8	8½
A, a, from frontal ridge to tip of muzzle,	2	0
c, d, horns apart anteriorly at base,	1	0½
e, f, tip to tip of ditto,	2	3¼
A. g. from nose to centre of eye,	1	0¾
g, h, eye to root of horn,	0	4¼
g, k, eye to base of ears,	0	6
l, m, humerus, &c.	1	11¼
m, n, radius,	2	8
n, o, metacarpus,	0	9¾
o, p, pastern, &c. and hoof,	0	7¼
q, r, pelvis,	1	4½
r, s, femur,	1	7¼
s, t, tibia and fibula,	1	10
t, v, metatarsus,	1	4
v, w, pastern to end of hoof,	0	7½
C. D. perpendicularly, about	5	9
C. X. length of dorsal ridge,	2	5½
tail-root to tip of hairs,	3	1¾
k, y, circumference of head behind horns,	3	11
i, z, neck behind ears,	4	0½
C, 2, chest,	8	8
3, 4, muzzle,	1	9¼
5, 6, fore-arm close to axilla,	1	11¼
7, 8,	0	9
9, 10, thigh close to body,	3	0¾
11, 12, thigh close above hock,	1	6

"Irides grey; muzzle black; horns pale, with dark tip; hoof, blackish."

I am, Sir,
Yours obediently,
Ed. Blyth.

Report for May Meeting.

Sir,—On the present occasion, I have comparatively few donations to announce to the Meeting.

In the class of mammalia, our most interesting acquisition is the remarkably handsome Fox from beyond the Sutlej, already announced as having been presented by Mr. Lushington. I presume it to be the *Vulpes Nipalensis*, Gray, *Mag. Nat. Hist.*, N. S., I, 578, according so far as can be made out from the very imperfect description there given; but notwithstanding the differences of colour, and length and quality of fur, apparent between this and our specimen of the common Himalayan Fox, upon which Dr. Pearson founded his description of *V. montanus*, vel (subsequently) *V. Himalaicus*, Ogilby, I cannot, after full consideration, regard them as specifically distinct, but consider this to be a variety merely, from a colder habitat, or perhaps a winter-killed individual, though I am unaware that any of the *Canidæ* renew their coat more than once in the year. Certainly, with regard to the name *Nipalensis*, Mr. Hodgson, who has so long pursued his zoological researches in that province, would seem to be unaware of any Nepâlese species additional to *V. montanus* and *V. corsac;* a circumstance which also tends to cast a doubt upon the *V. Hodgsonii*, likewise insufficiently described by Mr. Gray, *loc. cit.* The specimen now exhibited may, indeed, be tolerably well referred to either of the *half-descriptions* indicated.*

Length thirty inches from nose to base of tail, the tail with hair sixteen inches; from nose to base of ear five inches and a half, and ears (measured posteriorly, and making some allowance for their having shrunk,) four inches; height of the back fifteen inches. Fur exceedingly rich, dense, soft and fine, the longer sort measuring fully two inches upon the back, and the inner everywhere of considerable length and woolly character. General colour pale fulvous, scarcely more than fulvous-white over the shoulder-blades, and but little deeper on the sides, the haunches and tail appearing greyish, while the middle of the back is much deeper and more rufous fulvous than the rest, widening upon the croup, and passing there into the greyish appearance of the haunches; outside of the ears deep black to near their base (as in ordinary *montanus*); and the under-parts mingled white and faint nigrescent, the latter being the general hue of the inner fur at base, and more or less developed on different parts. Head light fulvous mixed with white, and marked as in other Foxes; the darkish streak from the eye to the moustachial bristles faint, the latter black, and cheeks and jowl white as usual. Limbs about the same pale fulvous as the head, the ordinary mark in front of the fore-limbs inconspicuous, though indicated by grizzled black and white-tipped hairs: tail bushy and white-tipped, with also a white mark across its upper surface near the base, above which the colour is the same rufous-fulvous as the croup, while ascending on each side of the buttocks is some whitish, which is divided by a narrow rufous stripe at the mesial line; the rest of the tail being pale dull fulvous with the hairs slightly black-tipped.

Captain Hutton states (*J. A. S.* VI, 934,) of *V. montanus*, that "the males are larger and much darker than the females." The very pale specimen, however, here described is a male: and should my specific identification of it be correct, the *V. mon-*

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* "*Vulpes Nipalensis.* Fur soft, silky, long; above, bright fulvous-yellow.

"Inhabits Northern India, Nepâl.—*Gen. Hardwicke.*

"Like the common European, and American fulvous, Foxes; but the fur is much softer and brighter coloured.

"*V. Hodgsonii.* Fur rather woolly; above, bluish grey. Forehead, nape, and middle of the back, yellowish-brown. Tail-end, black. Chin and beneath, white.

"Inhabits North India, Nepâl.—*Hardwicke.*"

With respect to "tail-end black," I suspect that Col. H. Smith's observation will be found to apply, that "of the hundreds of [English] Foxes and skins examined by us, although there be many with the end of the tail apparently black, we have not found one where there was not a white tip within the black; although most Foxes occasionally pull out the hairs at the end of the tail." Dr. McClelland writes, of the Fox of Kemaon, "he has grey legs, becoming darker to the feet; dark sharp nose; bushy tail, *that of the male having a white tip;* the upper surface of the ears velvet-black, inner surface cream yellow." 'Geology, &c. of Kemaon,' p. 220.

tanus would accordingly appear to be subject to considerable variation in shade of colour, like the allied *V. fulvus* of North America. In connexion with this subject, I may further remark, that Lieut. Irwin mentions "black fox" skins, together with those of the "common brown fox," as among the "commodities sent from Independent Toorkistan to the marts of Chinese Toorkistan.* "The Fox of Toorkistan," he observes, "and generally of the cold and temperate countries, has all the cunning of the English, unlike the puny Fox of India"; the former probably referring to the common Himalayan species, rather than to the Tibet Fox (*V. ferrulatus*) of Mr. Hodgson; though regarding the cunning of those of Kemaon, Dr. McClelland writes—"They are somewhat larger than the English Fox, and *are very easily caught in traps*," whereas the Jackal there, which is much larger than the Jackal of the plains, is remarkably shy and cautious, so much so as never to allow itself to be caught in a trap."†

In Afghanistan, according to Dr. Griffith, "a large and a small species of Fox appear to exist. The former, which is perhaps identical with the large Himalayan Fox, I procured from Quetta and at Olipore, at which place it is not uncommon.‡ The small kind seems to resemble the Fox of the plains of N. W. India."

Of the latter, or more exclusively those of the great Western Hurriana desert, the Hon. Mountstuart Elphinstone remarks, that these are "less than our [the English?] Fox, but somewhat larger than the common one of India: their backs are of the same brownish colour with the latter; but in one part of the desert, their legs and belly up to a certain height, are black, and in another, white. The line between those colours and the brown is so distinctly marked, that the one kind seems as if it had been wading up to the belly in ink, and the other in white-wash." *Account of Cabul,* &c. p. 7. Specimens of the animals here indicated would be highly acceptable to zoologists.

I have been informed that a species more nearly resembling the English Fox than the small Corsac of the plains inhabits the Neilghierries; but no such animal is noticed in Mr. Elliot's catalogue.

In *Proc. Zool. Soc.* for 1837, p. 68, it is mentioned that "a new species of Fox, nearly allied to *Vulpes Bengalensis,* but evidently larger, Mr. Gray designated as *Vulpes xanthura,*" but no description is there published, nor habitat assigned, though this notice follows some descriptions of Indian animals. Naturalists, therefore, are not bound to trouble themselves about the priority of the name, should they chance to meet with the animal here alluded to. It cannot, surely, be the "Fulvous-tailed Dog (*Canis chrysurus,* Gray)," a description of which is published in *Mag. Nat. Hist.* N. S. I, 157, and which is stated to inhabit India. I subjoin reasons, however, for suspecting that it is the same, and here indicate the animal as one regarding which further information would be acceptable.§

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* Red, grey, brown, and black Foxes are stated to have been formerly very numerous in the Aleutian Isles, whence the name of "Fox Islands" applied to this group, or rather chain. Does the American species extend across to Asia like the Rein Deer, Argali (?), &c.?

† Captain Hutton remarks, of the Jackals of Simla, that "they do not appear to hunt in packs as they do in the plains, but are seen singly." *J. A. S*, VI, 934. Is it certain that they are of the same species?

‡ For further particulars concerning *V. montanus,* vide *J. A. S.*, VI, 934.

§ "Fur pale, foxy, varied with black-tipped rigid white hairs, which are most abundant on the sides, and only scattered on the hinder part of the back. Under fur soft, silky; of the back

The wild *Canidæ* of India may, I suspect, be reduced to the following species:—

Subgenus *Cuon*, Hodgson, vel *Chryseus*, H. Smith, perhaps comprising a plurality of species, though actual comparison of specimens is necessary to establish these.

"Upon the Himalaya," writes Mr. Ogilby, "the common Wild Dog, called simply *Junglee Coota* in the plains, and *Buansu* in Nepal, [*Colsun* or] *C. Dukhunensis* of Sykes, and *C. primavæus* of Hodgson), is only found in the lower regions, but is replaced further up by two other wild species, likewise called *Junglee Coota* by English sportsmen. Lieutenant Smith informs me, that one of these is larger and the other smaller than the *Junglee Coota* of the plains, from which they both differ in having shorter tails and a lighter or more ashy colour: both species ascend the hills even to the snow-line; they hunt in packs, and inhabit ravines, and rocky dells; but being excessively shy, are not very often seen. The *Junglee Coota* of the plains, in other respects, does not appear to me to differ from the *C. Sumatrensis* of Hardwicke."* *Zoological Appendix to Royle's Illustrations.*

Mr. Hodgson merely informs us, that "the breed of Tibet is large, and of a pale Wolf-like colour," but he only possessed skins of "very young animals;" and this would seem to be the race observed by Moorcroft in his journey to Ladakh (Travels, I, 13), and by him styled "Wolves." One of his party, in advance, disturbed a pack of them in the act of pulling down a Surrow, and having put them to flight, and secured their victim, "the Wolves kept prowling about us, and were not finally dispersed until several shots had been fired at them. They were of a reddish colour, with long, lank bodies, and bushy tails. The natives call them *Khoa*," spelt *Qyo* by Dr. Spry and others, and *Quihoe* in Johnson's 'Indian Field Sports,' referring to the animal of Central

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fulvous; of the sides whitish; lead coloured at the base of the hairs. Cheeks, chin, throat, and belly, white. Sides of the chest, inner sides of the legs, yellowish white. Upper part of the legs, and anal region, bright reddish-fulvous. Tail cylindrical, reaching nearly to the ground, pale yellow, with a dark brown tip, and a large tuft of rather rigid hairs (placed over a large gland at its upper part near the base. Ears rather large acute, grey, and edged with black externally; internally, whitish. Length 23½ inches, tail 10 inches. Specimen in British Museum."

From the particular mention of the caudal gland, in addition to the hue of the tail, I am really induced to suspect that this is, after all, no other than the *Vulpes xanthura* above referred to; for of the latter it is mentioned that "in describing this species, Mr. Gray remarked, that it had a large gland, covered with rigid brown hair, on the upper part of the base of its tail, very distinctly marked, and that on looking at the tail of the several other species of this genus, as *V. Bengalensis* [*Corsac*], *vulgaris*, *fulvus*, and some others, a similar gland was easily recognisable, though it appeared to have been hitherto overlooked." The same may be seen on the tail of a Wolf or Jackal, as must, I should think, be familiar to most observers.

Mr. Gray also described, on the same occasion, a "*Canis procyonides* (Raccoon-faced Dog). Grey-brown, varied with black tips to the hairs. Cheeks and legs dark chocolate-brown. Tail short, thick, pale brown, with white tips to the hairs. Ears rounded, hairy. Length of head 5½ inches; body 17 inches; tail 5 inches. Inhabits China. Specimen in British Museum." This animal is figured in the "Illustrations of Indian Zoology" of Messrs. Hardwicke and Gray, where undoubtedly it is made to look marvellously Raccoon-like.

In the same work is also figured a "Dooab Fox" (*V. rufescens*), but, so far as can be judged from the plates, it would not differ from the ordinary Corsul, unless in the total want of annulation to the fur, which is not very probable.

I republish these notices to aid the investigations of enquirers in this part of the world, and in hope of preventing, as much as possible, a needless multiplication of synonyms.

* In the latter author's description of the Sumatran wild Dog (*Lin. Trans.* XIII, 236), it is remarked that "the resemblance between this animal and the wild Dog of the Ramghur hills, called *Quao*, is strikingly close; the colour of both is the same, the black bushy tail the same, as also the form of the nose; but the ears of the Sumatran Dog are more rounded."

India; terms which, as Colonel H. Smith remarks, "appear to signify imitations of the animal's voice when hunting."

From Herbert's 'Gleanings in Science,' I. 280, I extract the following: "The *Bhowsah* [Buansu] are found in many parts of the hills of North-western India: there are two kinds, one denominated the Shikárí, and the other the Lágh: the latter is much stouter than the former, and its hair longer and darker; it is not so fleet as the Shikárí, but possesses a much finer nose; it quickly regains the scent when lost by the *Shikdri:* it takes the name of *Lagh* from eating the offal of its prey, which the *Shikdrí* does not."*

A "Red Wolf" is mentioned by geographers as inhabiting the Great Altai; and "Wild Dogs," in addition to Wolves, Jackals, and Foxes, are noticed by Elphinstone to occur in Afghanistan. Such an animal is mentioned by Colonel H. Smith, as "the *Beluel* of Avicenna, which that author seems to have considered to be the *Thos* of antiquity. This," continues the learned naturalist cited, "we take to be the *Beluch* of Beloochistan, one of two species of wild canines found in the woody mountains of South-eastern Persia, and probably extending along the high lands West of the Indus into Cabul. It is described as a red wild Dog, very shy, and extremely ferocious, hunting by day in parties of twenty or thirty, seizing a Bullock or Buffalo without hesitation, and tearing the animal to pieces in a few moments. A British Officer, who traversed a part of this wild region of alternate jungle and sandy plateau, deeply scarred into long and parallel furrows, barren and vertical, so that no quadruped can cross many without complete exhaustion, observed a group of these red Dogs lying on the edge of the forest, yet on the watch for game, but they withdrew into cover before he could fire at or completely examine them: they were, however, long and rather low on the legs, of a rufous colour, with a hairy tail and a powerful structure: their foot-marks on the sandy soil were very distinct, and indicated that their feet were exactly like those of a Hound. The native peasants related that they keep aloof from human habitations, and consequently do little injury to human property; but that no animal, especially if it be entangled in the billowy ridges before mentioned, can escape their pursuit. Having demanded some particulars about their structure, they pointed to a domestic Dog then present, and said that the *Beluch* was much like it, but larger and destitute of white colour, which marked the domestic animal; but that there existed, further to the West, a wild species still larger than the red, which had so much white that the brown and black occurred upon its back in the form of spots." The account here given strikingly agrees with that of the Wild Dog of the Rajamahendri district furnished by Major Pew, and appended to Col. Sykes's description of the *Colsun* in *Trans. Roy. As. Soc.* III, 411, so that there can be very little, if any, doubt of their applying to the self-same species, together with the following.

"*The Red Wild Dog of Southern China,*" continues Col. Smith, "is most likely another race or species of this subgenus. It is described as resembling the Dingo of

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* A corresponding distinction is said to obtain among the Wolves of North America. Thus, in Silliman's Journal, VI, 93, we read, of those of the Catskill mountains (a series of ranges extending from the vicinity of the St. Lawrence to the Alleghany ridge), that "Two varieties of Wolves are met with, one called by hunters the Deer Wolf, from his habit of pursuing Deer, for which his light Greyhound form adapts him: the other of a more clumsy figure, with short legs, and large body, more frequently depredates upon the flocks under the protection of man."

Australia, though somewhat lower on the legs; but whether this or the Beluch wants the second tubercular tooth, has not been ascertained." *Nat. Libr., Mam.*, IX, 173-5. In the tropical countries eastward of the Boorampooter, it has been generally understood that no wild canine animal exists, as appears to be truly the case with the Jackal; but I have information (and trust to receive specimens) of two species, differing much in size and habits, from the interior of Burmah, besides which I am told that "a Fox resembling that of Bengal, but of a darker colour, and altogether more resembling the English species except in size," inhabits the Siamese hills. "Wolves" are mentioned in Capt. Low's list of the animals of Tenasserim (*Journ. Roy. As. Soc.*, III, 50), "and Wolves, or perhaps wild Dogs," are elsewhere stated by him to inhabit the same range of territory. In Dr. Richardson's 'Mission to the Court of Siam,' (*J. A. S.*, IX, 5), Hares are mentioned,* "and Wild Dogs are said to be numerous here [near Camboorie], larger, with longer hair than the common Dog, but equally varying in colour." These would seem to be scarcely referrible to the present group.† In Sumatra, we have seen that they exist, and Sir Stamford Raffles alludes to more than one race in Java (*Lin. Trans.* XIII, 249), remarking that how far the Sumatran animal "differs from either of those of Java, Dr. Horsfield will be able to decide." I am unaware, however, that the latter naturalist has published any notice on the subject. Dr. Solomon Muller, if I remember rightly, mentions them by the name of *Canis rutilus*, as alike inhabiting Sumatra, Java, and Borneo (?); and a Java specimen was first taken to Europe by M. Leschenhault, "in size and in proportions equal to a common Wolf, but the ears are smaller; the colour is fulvous-brown, blackish on the back, feet, and tail." Within the Indian Peninsula, the *Colsun* of Sykes, according to Mr. W. Elliot, "was not known in the Southern Mahratta country until of late years. It has now become very common."‡

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* Vide my Report for January, *ante*, p. 102.

† In a notice of some of the animals of the Tenasserim provinces, published in the *Bengal Sporting Magazine* for August, 1841, page 44, we read that — "The Wolf is said by the natives to have been in the country of the Kareans, as also the Wild Dog; but their accounts are not much to be relied on." It is at least probable, however, that wild canine animals of some kind are alluded to.

‡ *Madras Journal*, No. XXIV, 100. I may here cite a very interesting notice of this animal in the 'Madras Journal,' No. XIV, 81: "The animal termed by us the Wild Dog," writes Captain A. Mackintosh, "is known to the natives by the name of *Kollussnah*, *Kollusra*, and *Kollusa*. It is common in the Kotoul district, and all along the range of western Ghauts. It is about the size of a Panther [which would be very much larger than any I have seen], with very powerful fore-quarters, narrow tapering loins, black and pointed muzzle, and small erect ears. The tail is long, and at the extremity there is a bunch of hair several inches in length. The Kullussnah is of a darkish red colour, possesses great speed, and hunts in packs of five, eight, fifteen, and even to the number of twenty-five; is extremely active, artful, and cunning in mastering its prey. It is during the night-time they move about in search of food; but, should an animal approach near them, an hour or two after sunrise, or a short time before sunset, they will attack it —all animals seem instinctively to dread them. During the day-time, they remain quiet in their hiding-places. When the Kollussnah discovers an animal worthy of being captured, the circumstance is announced to the pack by a barking, whistling voice; the others are on the alert, advance rapidly and post themselves slily round the spot, and gradually close in on the animal. Upon seeing one or two of the Kolussnahs he gets frightened, but much more so when, running away at speed, he encounters one of his enemies in whichever direction he attempts to escape. The consequence is, that he stands quite amazed. Some of the Kollussnahs run in close to him, and shed water on their bushy tails, which they swing about and jerk into his eyes; he is successively saluted

To sum up, Colonel H. Smith remarks, that—"On reviewing the notices of the present group of Wild Dogs, whether they be one or several species, it is evident that they extend their habitat over an immense surface of Asia; and since they are found to the westward of the Indus, it is likely they inhabit the deep forests along the Caspian, and continuing in the same parallel of latitude, that they have existed and possibly may still be found in the mountains of Asia Minor. If, now, we compare the foregoing descriptions [*Nat. Libr.*, *Mam.*, vol. IX,] with the account of λυκος Ξουρος or *Aureus* of Oppian, which he relates was a resident of the rocky jungles of Mount Amanus and Taurus of Cilicia, a province where he, the poet, naturalist, and sportsman, was born, we cannot suppose that he spoke wholly from hearsay, and ignorant of the characters of his Golden Wolf, mistook it for a Jackal, then not frequent so far to the North; but which in comparison is insignificant, does not fear the heat, nor retires during the appearance of the Dog-star*; is not of a bright fulvous colour, but greyish in Natolia; is not to be mistaken on account of its howling; burrows in the vicinity of human habitations; is the reverse of a shy and solitary nature; and finally is not noticed by him under another name.† The uncertainty and confusion respecting this group commenced with the ancients, who ranged in all probability not less than three very different canines under the name of *Thoes*. Pliny speaking of a *Thos*, which he viewed as a kind of Wolf, merely remarks, that it had a longer body, shorter legs, sprang with velocity, and lived by hunting; adding, not dangerous to man.‡

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in the same manner, when he approaches them, or they run into him. The unlucky beast is soon blinded by the peculiar escharotic quality of the application; for he begins to stagger and run round and round, and is now beset by all the Kollussnahs who make a loud barking and snapping noise while they pull the animal down and tear it in pieces. When few in number, they have been known to gratify their hunger before the poor animal fell down and expired, each of them tearing away a mouthful while their victim remained standing. There are very few instances of their ever having attacked the villagers' cattle, but they will kill stray calves if they fall in with them. The Kolies never molest the Kollussnah, in fact they are glad to see them in their neighbourhood, being aware of the enmity that exists between them and the Tiger, for they kill that animal occasionally; and in consequence they are considered by the people as the protectors of their cattle and their fields, for neither Sambur, Deer, or Hog, seem disposed to approach places much frequented by the Kollussnah. They hunt and kill the Sambur, Neelgaie, Hyæna, Deer, Jackals, Hares, Hogs, Bears, Porcupines, and Quails. They killed a Tiger in June, last year, in the Taloongun jungles."

For a detailed account of the *Buansu* or wild Dog of Nipal, by Mr. Hodgson, vide *As. Res.* XVIII, pt. II, where also are given comparative figures of this animal, the common Indian Fox, and the Jackal. A writer in the Bengal Sporting Magazine, for 1838, p. 404, mentions, that on removing the skin of a "Wild Dog," which he shot near Saugor, "hundreds and hundreds of thorns, of bushes and the spear-grass, were observed lying in the thin membrane between it and the muscles; everywhere, but chiefly in the front part of the fore and hind legs; there was no symptom of inflammation from them, except in two wounds where a little matter had formed: the coat was quite smooth, and there was no vestige of parasites about the animal." The same writer mentions the cry of these creatures when in pursuit of prey, as "the palpable bark of the Dog, but shorter and not so deep, and I thought at the time, as they rushed by me on the right and left, that there was something very angry in the tone of it. Their run was perfectly beautiful, and all together they disappeared, eight in number, over the hill, still preserving the form of a row."

* Sirium orientem metuit.

† Oppian's *Thous* was a spotted animal.

‡ "Luporum genus est (*Thos*) procerius longitudine brevitas crurum, dissimile velox saltu, venatu vivens innocuum homini." *Pliny.* Ælian's *Thoes* may be Jackals: but the *Thoes* of Homer, described as put to flight by the Lion, while they surrounded the Stag at bay, cannot be Jackals but the *Chryseus*. So also is the *Thos* of Aristotle, when he notices their engaging the Lion.

All these characters are perfectly applicable to the *Chryseus* of our type, and to its varieties. The mistaking of Oppian commenced with Belon; and Kæmpfer, being unacquainted with the existence of the rufous Wild Dog, referred *Aureus* to the Jackal, and misled Linnæus.*

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* "It is even more likely," continues Col. Smith, "that from this group the mixture with a domestic race might be reported to have been obtained, which the ancients, and even Aristotle, repeatedly assert to be the *Alopecides* or the Chaonian and Spartan breeds, but which, from their strength and courage, could never have resulted from crossing Dogs with Foxes.

"There is some reason to presume that the *Chryseus* formerly existed in Southern Europe: for to what other species can we refer the kind of Wild Dogs noticed by Scaliger, as existing in the woods of Montifalcone in Italy. 'There resided,' he says, 'for ages about Montifalcone, a species of wild Dogs; animals differing from Wolves in manners, voice, and colours; never mixing with them, and being particularly fond of human flesh.' This last character may have been a gratuitous addition of his informants: he does not, in this paragraph, notice the particular colour, but, in a another part of the work, wild Dogs of a rufous colour are incidentally recorded. A family of the name of Montifalcone bore a Wolf salient gules; while another of the same name had red Dogs for supporters, in a collection of blazoned Italian arms in the Library of St. Mark at Venice."

I shall now proceed to invite the attention of observers to the following notices by the same indefatigable and learned Zoologist:—

1st.—"With some hesitation we place here the short notice of the *Wak*, a canine designated as a *Dhole*, but possibly a very distinct species. It was first mentioned to us by the late Lieut. Col. Deare, of the 8th Dragoons, who was a native of the East Indies, a keen sportsman, and many years resident in that part of the world. A printed account of a similar animal, observed in captivity, has since appeared in one of the Annuals: both agree in the description, one having been killed in Central India, the other seen in the Southern Provinces. This *Dhole* was represented to be a robust thick-bodied animal, nearly equal in height to a harrier hound, but heavier in weight; the head broad and ponderous; the forehead flat, with a greater distance from the ears to the eyes than from these to the nose; this was blunt, dark-coloured, and rather broad, the rictus or gape black, opening to beneath the eyes, which were of a greenish-yellow, set in dark eye-lids, and offering a most ferocious aspect; the teeth powerful; the legs and claws remarkably strong, resembling a Bull-Dog's; and the tail rather short, but more bushy towards the end, and sooty in colour: the general colour of the fur tanned, browner on the back, and some white on the breast, belly, and between the limbs. It growled with a deep threatening voice, and the natives related that, in danger, the animal, by means of the tail, flings its urine in the eyes of the pursuers. The Colonel considered this not to be the true *Dhole*, and characterized it as reminding the spectator of a low legged Hyæna with the colour of a Dog; but he was too familiar with the *Hoondar* (or Hyæna) to mistake it for that animal. It was reported to hunt in packs, uttering an occasional deep-toned bay.

2nd.—"The true *Dhole* (*Chryseus Scylax*, H. Smith; *Dhole* of Captain Williamson, and *Quihoe* of Dr. Daniel Johnson). These names here brought in juxta-position, shew how much confusion there exists in designating this and other species among the natives of India; a confusion they extend to Hyænas and Wolves. *Qyo, Quihoe* and *Qao*, appear to signify imitations of the animal's voice when hunting; *Dhole*, a Pracrit name; but it is evident that where the names of *Hoondar* and *Beriah* (Hyæna and Wolf) are considered synonymous, species still more indistinctly marked may well be expected to be confounded. The *Scylax* is described to be in size between the Wolf and Jackal, slightly made, of a light bay colour, with a sharp face, and fierce keen eyes; in form approaching a Grey-hound; the tail straight, not bushy; the ears wide, pointed, open, and forming a triangle; the skin dark; nose, muzzle, back of the ears, and feet, sooty. From this description the animal differs from *primævus* and the other races, in being more slender and higher on the legs, in having a sharper muzzle, a long close-haired tail, and large dark ears. It is reported to hunt in packs of greater numbers, to utter a cry, while on the scent, resembling the voice of a Fox-hound, intermixed with occasional snarling yelps. Dr. Daniel Johnson witnessed a pack attacking a wild Boar.

"The drawing we possess of *Scylax* was taken from a carefully executed Indian water colour painting, observed in a collection on sale in London, some years before Captain Williamson's 'Oriental Field Sports' was published. Colonel Deare, then a Captain, was about this time in

The Australian Dingo is generally referred to this particular group of Canines, but differs from the rest (if more than one species) hitherto examined, in possessing a second true molar in the lower jaw, wherein the *Colsun* or *Buansu* differs from all others of its natural family (so far as known), wild or tame, with the exception of a Brazilian fossil species recently discovered by Dr. Lund. This character alone supplies an insurmountable objection to the hypothesis of Domestic Dogs having derived from the so called *Canis primævus.*

2. *Canis Lupus;* the Wolf: considered as a peculiar species *(C. pallipes)* by Col. Sykes. Mr. Walter Elliot, however, remarks, that "this species does not appear to differ from the common Wolf. Three young ones which I had alive for some time agreed very well with the description of the *Canis pallipes* of Col. Sykes, but several adults that I shot differed in their colours and general character. The head was large, the muzzle thicker, the colours in some cases more inclining to red, particularly on the fore-legs, which in some cases were deep red; and the same colour was found on the muzzle from the eyes to the nose. Others have more rufous on the hind-legs, together with some black on the thighs, rump, and tip of the tail [European Wolves vary in like manner]. Length from muzzle to insertion of tail thirty-six to thirty-seven inches, ditto of tail sixteen to seventeen inches and a half; height of shoulder twenty-four to twenty-six inches; length of the head ten inches; circumference of ditto, sixteen or seventeen inches; weight of an adult female 42 lbs."

The Wolf appears to be numerous on the open plains of India, but to be generally unknown in the wooded hilly parts. Col. Sykes informs us, that "they are not met with in the woods of the Ghauts" of Dukhun; nor is the species mentioned in Mr. Hodgson's 'Classified Catalogue of the Mammals of Nepâl' (*J. A. S.*, X, 908).* Col.

London, and the copy being shewn him, he first conveyed the information that it represented the *Dhole*, or, as he termed it, the *true Dhole*, distinct in form from the other species already mentioned. In Europe, that name was then only known to a very few persons who had previously resided in India. Specimens occur, it seems, very rarely, and these only in the Rhamghany hills, and sometimes in the Western Ghauts." This may be one of the Himalayan races mentioned by Mr. Ogilby and others.

3rd.—" The *Dhole* of Ceylon *(Canis Ceylonicus*, Shaw). First described by Vosmäer This species is evidently much allied to the last mentioned, although the account of it was not taken from an adult. The stuffed specimen was not much larger than a domestic Cat, measuring about twenty-two inches from nose to tail, the tail itself sixteen inches, gradually tapering to a point; the colour yellowish-grey with a cast of brown, owing to some hairs of that colour being longer than the rest; the feet strongly tinged with brown; the hair close but soft to the touch; the head long and pointed; the snout and under chin brown, but the top of the head yellowish-ash colour, which, passing beyond the ears, forms a spot below them and terminates in a point below the eyes; the ears were small, elevated, and pointed. In this specimen, the last molar of the lower jaw was also wanting [from immaturity?] The claws resembled those of a Cat more than of a Dog, and there were five toes on the hind as well as on the fore feet. We have examined, in Holland, the skin of a Dog which was said to have come from Ceylon, and corresponded sufficiently to admit of its being the same species, although it was at least four inches longer, and the colours were less grey and more fulvous; the tail was long and without a bush, and the claws blunt, but with five on each foot. It is evident that the discrepancies between the two were owing to nonage in Boddært's specimen. The skull we have not seen."

All these notices require exceedingly to be verified upon examination of specimens.

* "The common Wolf is numerous in the plains, but I have never seen or even heard of them in the Himalaya.

"The Jackal is rare there, and I have never met with them but in the low and warm valleys."—*The Rev. R. Everest on the power of enduring cold in the Mammalia of Hot Countries.—Mag. Nat. Hist.*, January, 1842.

Smith seems to believe in the existence of a smaller race, "lower, with a broader back, and of a light grey colour, obscurely marked with darker cross bars, from the tips of the hairs being black; the limbs and face pale buff. A specimen, shot among the rocks on the sea-shore, near Vincovah, in the vicinity of Bombay, was in colour yellowish-grey, brindled with blackish streaks: the head was sharp: the under-parts dirty-white; the tail not very hairy, whitish below, and the markings on the body distinct. It was killed in the act of searching for offal and putrid animal matter cast on shore by the sea."*

3. *C. aureus;* the Jackal. Common to all India westward of the Boorampooter, and extending (without satisfactorily known variation) to Anatolia, Turkey, the Island of Candia, part of Greece, and the southernmost confines of Russia; but, I believe, unknown in Africa, where represented by allied species. Syria and the north-east of Africa are, indeed, remarkable for the variety of small indigenous canines described by Ruppell and by Hemprich and Ehrenberg; and the following has, probably, still to be added to their number (vide Kotzebue's 'Journey to Persia', p. 62). "In Grusia, among the beasts of prey, there is a species of Jackal which is called *Tshakatka.* It resembles the Wolf, but is smaller and has a much more ferocious appearance; its howl shakes the very soul. The animal is, besides, very bold, and sneaks during the night into the camp to steal the soldiers' boots. When very hungry, it enters burial grounds and digs up the bodies recently interred." It is thus a true Jackal, but there is reason to suspect a larger species than the common one.

4. *C. chrysurus,* Gray, vel (?) *Vulpes xanthura,* Gray, already noticed.

5. *Vulpes Corsac,* v. *Bengalensis, Indicus, et Kokree.* Mr. Elliot states of this species, that "it is remarkable that though the brush is generally tipped with black, a white one is occasionally found [*i. e.* in the Southern Mahratta country], while in other parts of India, as in Cutch, the tip is always white." In Bengal I have hitherto found it invariably black-tipped. This animal appears to be common throughout India, extending, it would seem, westward of the Indus and into Tartary. The varieties (?) mentioned by Elphinstone, as already cited, inhabiting the Western Indian desert, require investigation; as also the Dooab Fox of Hardwicke and Gray.

6. *V. montanus,* vel *Himalaicus,* vel ? *Nipalensis et Hodgsonii* of Gray, the latter probably mere varieties of colour, and not more different from the ordinary type than the beautiful specimen exhibited on this occasion. The Neilghierry Fox is, probably, an additional species, unless it prove to be Mr. Gray's *Chrysurus* vel ? *Xanthura* which however is unlikely.

From Mr. J. J. Athanass, have been received ten heads of the Indian Antelope (*Antilope Cervicapra*), one only being that of a female, and among those of males there is one remarkable for the deformity of its right horn, which curves shortly round to form a circle and is then broken off: this horn indeed considerably resembles that of a castrated individual which lived some years in the London Zoological Gardens, and which possessed a horn on one side only, of similar flexure, the other side having no more trace of it than in the female of this species; and it may be, therefore, that the testis of the corresponding side had been injured in the animal whose head is now exhibited, a circumstance which, in the Cervine genus, is well known to affect the development of the antler of that side; and a very curious circumstance is related (*Lin. Trans.* II, 356,) of a female *Cervus Elaphus*, " which had one horn perfectly similar to that of a Stag three years old. It never had a horn on the other side of its head, for there the corresponding place was covered over by the skin, and quite smooth. It did not seem to have ever produced a fawn, and upon dissection, the *ovarium* on the same side with the horn, was found to be schirrous." The true facts relative to the development of antlers in castrated Deer, as observed in a number annually gelded in the Royal demesne of Richmond Park, do not appear to be generally known : the antlers which the animal had borne at the time of the operation are shed in due season, though later than in the perfect animals, and they are regularly succeeded by others which never fall, nor cease growing from time to time, slowly and weakly, and shooting forth most irregularly with regard to shape, the velvet, or hairy skin investing them, being, under these circumstances, of course permanent; though (at least in some groups) it appears that where this animal is emasculated while young, the antlers do not appear at all, as instanced by a " heaver" or ox Sambur (*C. Hippelaphus,*) whose skeleton is in the Museum of this Society. The currently received doctrine on this subject is still that of Buffon (*Hist. Nat.* VI, 81), who asserts " Si l'on fait cette opération dans le temps qui'l a mis bas sa tête, il ne s'en forme pas une nouvelle; et si on ne la fait au contraire que dans le temps qu'il a refait sa tête, elle ne tombe plus, l'animal en un mot reste pour tout la vie dans l' état on il etoit lorsqu'il a subi la castration," which appears to be taken for granted by all subsequent writers.* I may take this opportunity, too, to remark that in the park surrounding Government House, at Madras, there is a very large herd of Indian Antelopes, being the posterity of a single tame pair. The gentleness and familiarity of these beautiful creatures surprised me considerably, knowing how dangerous a solitary tame one is apt to be, particularly when its range is limited; but I learned that not a single accident had ever happened in the present instance, though the bucks are commonly heard groaning and fighting at nights. As I drove past them, they were lying and grazing on each side as quietly as Sheep, and now and then two or three would be seen skipping after each other, more lightly than Fallow Deer, which latter they much resembled in their trot. Among the whole large herd, I observed but a single coal-black male, though very many had fully developed horns; nor is more than one such ever seen, I believe, in the wild herds, however extensive, the rest being driven off as they attain complete maturity.

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* Communicated to Col. Smith by Col. Dunsterville, H. C. S., who was present.

Gazella cora, H. Smith (vide page 452, *ante*); seven heads, including two of females.

Cervus Axis: two heads.

Gavius Gangeticus : a large stuffed specimen, and the head of a smaller one.

From —— Hamilton, Esq. C. S., of Mirzapore,

Hyæna vulgaris v. *virgata :* skin and skeleton. The former has, with considerable patience and difficulty, been mounted, and now forms a very tolerable stuffed specimen.

From G. Hugon, Esq. two frontlets of Deer, from the Mauritius. What this Deer is, if described at all, I do not know, though I have long been acquainted with the skull and antlers of the species, of which there is a fine specimen in the London United Service Museum, and a frontlet in the private collection of Mr. Hill: there was also previously an example of the skull of this animal in the Museum of this Society. In *Proc. Zool. Soc.*, for 1831, 45, the late M. Desjardins enumerates *Cervus Elaphus* in his Catalogue of Mauritius animals, which, if referring to the present species, as must be supposed, is a strange error. Duvaux, in his 'Letters from the Mauritius' (p. 295), remarks, that "the Stags [of that island] are muchsmaller, and of a greyer colour, than those of Europe, and are supposed to have been introduced by the Portuguese." A friend who has hunted them can merely inform me that they have a remarkably shaggy coat, but at once recognized the Society's former specimen above alluded to as belonging to the species. The antlers are proportionably large, and might be mistaken by even a practised eye for those of the Sambur *(C. Hippelaphus)*; but the skull is considerably smaller than in that animal, and accordingly the antlers are nearer together at base: in every specimen which I have seen, the inner tine of the terminal fork is very much longer than the outer one, being the reverse of what obtains in the common Spotted Axis, while in the Sambur and Jerrow, although this character is variable, the relative proportion is generally as in the present species, but to a less extent. In size the skull in the United Service Museum is larger than that which we possess, measuring (according to my notes) thirteen inches in total length, or from occipital ridge to the tip of *nasals*, over the curves, twelve inches; orbits apart posteriorly five inches, anteriorly four inches and a quarter; palate five inches, and two inches wide posteriorly. The pedicles of the antlers are one inch long, measuring on the inside, and those of the three frontlets before me are equally elongated, although the antlers are of full dimensions; the latter measuring, in the London specimen, thirty inches long, six inches and a half round above burr, and four inches and three quarters in the beam; the corresponding measurements, in the three specimens before me, being thirty, seven, and four and a half inches,—twenty-eight, seven and a quarter, and four and a half inches,—and twenty-eight, six, and four inches: they have the set and general form of those of the Sambur and Axis, and not (as in *C. equinus*, *Molluccensis*, and some other large Malayan species,) that of the common Hog Deer; and their granulated surface likewise resembles that of the Sambur's antlers. The skull in the Society's collection has its intermaxillaries imperfect, and the occiput is also incomplete; but from base of pedicle to tip of nasals it measures but eight inches and one-eighth, the greatest width of orbits apart posteriorly five inches, and anteriorly three inches and three-quarters, length of bony palate four inches and five-eighths, and width posteriorly two inches: there are the sockets of two small canines, but all the teeth are lost. Further information respecting, and especially specimens of, this animal are desirable, and there can be little or no doubt that it was originally imported from some part of the Malayan Archipelago.

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* For the above interesting piece of information relative to the *heavers* of Richmond Park, I am indebted to the celebrated animal painter, Mr. Hill, who shewed me a number of specimens illustrative of the fact.—E. B.

From Captain Ommanay, has been received a specimen of

Eurylaimus nasutus, v. *Todus nasutus*, Gmelin, *Cymbirynchus nasutus*, Vigors, and *Eur. lemniscatus*, Raffles.

From Robert Ince, Esq., Supt. of Salt Chokees, Zillah Backergunge, a specimen of a timber-perforating Worm, accompanied with the following particulars:—"Specimen of the Worm which destroys boats or timber while floating in the rivers of the eastern district of Bengal, more particularly in and near Backergunge and Furreedpore. This creature perforates the wood, leaving a mucilaginous deposit which hardens into a shelly substance. It is only found during the hot months, and is termed by the natives *Noona Kheen* ("Salt Worm"), as it is believed to be never met with out of brackish water, *i. e.* beyond the influence of the tides during the S. W. monsoon. Soondree wood is particularly liable to its attacks. The natives destroy the creature by hauling their boats ashore, and burning stubble beneath them."

This Worm combines the general form of *Nereis* with distinct eyes as in *Phyllodyce*, and is therefore inadmissable into any of the described genera with which I am acquainted. As in the former, its proboscis is furnished with a single pair of strong serrated mandibles or nippers, and there are three minute tentacles on each side posterior to its base; beside which, over the inner margin of each eye, is a rudimental *antenna* existing as a small tubercle. The rings of the body are very numerous, and are each furnished (as in *Nereis*,) with a branchial lamina, but having only one minute tubercle and small packet of bristles beneath. Length eight inches and a half, and present colour of specimen livid-white, becoming dark purplish towards the head; the proboscis white, and jaws horny-black. The natural colour is mentioned by Mr. Ince to be flesh-red. I shall designate it *Lignicola destructor*. Mr. Ince has promised a specimen of the timber perforated by it, and the Worm now presented to the Society was taken out of the bottom of the Chokee boat attached to the Superintendent's office of Backergunge.[*]

To the zoologist it will convey no information to be told that this and analogous species merely bore for a habitation, a fact sufficiently implied by the existence of visual organs in the specimen now exhibited, which would intimate that it watched for its prey at the entrance of its hole, as various allied genera are known to feel for it with their tentacles, these being, in the *Lignicola*, too minute to be of much efficacy for the purpose.

The specimens of *Vertebrata* procured in the neighbourhood during the past month have not been generally of much interest, owing to the impossibility of myself devoting any time to collecting, and the incorrigible worthlessness of the native Shikarees, by whose agency I have hitherto endeavoured to procure specimens. The most worthy of notice is an example of *Megaderma lyra*, which I myself took in the act of preying upon another Bat, the interesting circumstances connected therewith have been described in an article now printing for the Society's Journal.[†] Another specimen of *Pachysoma marginatum* has also been obtained, which had contrived to drown itself in a vessel of water in the Society's compound, and is at present prepared as a skeleton.

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[*] The specimen of perforated wood here adverted to has since been received, being completely honey-combed all over, the ravages of the Worm producing much the same appearance as those of the *Teredo navalis*.

[†] Vide page 255 *ante*. I have since made a capture of eight specimens of this Bat, from an assemblage of thirty or forty, (and I can procure others of these when I please), that pass the day hanging to the roof of a long roomy out-house, selecting a not very dark situation (as the *Rhinolophi* are said to do), though when disturbed they rarely attempt to escape by the open windows, being evidently much more incommoded by bright day-light than the restricted *Vespertiliones*, and when they do so pass out very soon settling upon any tree near at hand, and suffering themselves to be taken by an insect-net. Of these eight adult specimens, only two were males, intimating, however, that the sexes do not assemble separately, as is the case with various other Bats, while it is pretty clear that the females much exceed the males in number. The *Pteropodes* are also stated to herd in separate flocks, the males apart from the females, which I doubt; but here, again, it would seem that the females are much more numerous than the males, for of twelve specimens

In the class of Birds, the mass of small waders are now in beautiful summer plumage, and as fast as we can obtain specimens uninjured by the ruthless hands of the native dealers in the bazaar, they are secured for the Museum, or to be set aside for exchanges; but it is most provoking to observe the numbers of fine specimens, which despite all that can be said and reiterated to these people *ad nauseam*, the stolid savages persist in partially stripping of their feathers, or otherwise injuring so as to render them quite unfit for preservation; in illustration of which it will be enough to mention that out of the many hundreds of common Curlews (*Numenius arquata*) which have been brought to the bazaar in the course of the season, I have not yet been able to furnish the Museum with examples of this abundant species.

There is a curious fact relating to the changes of plumage in these birds, which I do not think has ever been distinctly stated: viz. that whilst they actually change their plumage, by renewal of the feathers, to a greater or less extent, the changes of colour are independent of the renovation of the feathers; thus the old feathers, prior to being shed, will be seen to have acquired more or less of the hue of the new ones which replace them; and these, in their turn, soon after the bird has bred, and long before the autumnal moult, gradually lose the hue which distinguishes the nuptial livery;[*] the latter is particularly exemplified by *Totanus fuscus*, wherein the deep sooty hue which imbues even the legs, in addition to the entire plumage, of this bird in nuptial garb (as illustrated by specimens now exhibited,) disappears totally after breeding in the same feathers, as I have witnessed in every stage of this absorption of colouring matter, so that the bird resumes very nearly the aspect of its winter uniform. It may further be observed, that, at the vernal moult, the amount of renovation of the feathers, and the period at which this takes place, are both very irregular, depending on the constitutional vigour of the individual; some weakly birds, both young and adults, the latter probably such as are past breeding, or otherwise sexually debilitated, undergoing little or no change even of colouring. It is also a remarkable fact, that when a bird drops its feathers at the regular moulting period, it sheds them alike whether new or old, even such as had grown in place of others that had been accidentally pulled out but a few weeks previously; while, if from debility or any other cause, as sometimes happens in a specimen newly caught and caged, the feathers do not fall at the proper season, they then remain till the next ordinary moulting period, however distant, *i. e.* for another year in what are termed "single moulting" species.

Circus Swainsonii, A. Smith, *v. pallidus* of Sykes, female.

Emberiza fucata[†] ? Pallas, Shaw's 'Zoology' IX, 385: described as "common on the rivers Onon and Trigodia, in Russia." A bird answering to the brief description by Shaw, is plentiful in the neighbourhood of Calcutta, to judge from its being

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passing over which I lately brought down, I could only get a single male. Collecting so many has enabled me to decide, that the specimen noticed in Vol. X, p. 840, does not differ specifically from the *Ph. Edwardsii* vel *medius*, Auctorum.

[*] I have even observed that, not unfrequently, the new feathers put forth at the vernal moult are only partially of the colour they afterwards assume.—E. B.

[†] Identified by Mr. Jerdon with his doubtfully cited *E. cia*. *Madr. Jl.* No. XXVI, 29.—E. B.

frequently brought for sale in the medley of species purchased as "Ortolans" by Europeans. I have long waited for uninjured specimens, and now exhibit two males and a female that at least have one side perfect. Size of the Cirl Bunting, and allied to this species in form. Length six inches, by nearly ten inches across; wing two inches and seven-eighths, and middle tail-feathers two inches and a half, the external rather more; bill to forehead (through the feathers) above half an inch, and the same to gape; tarse seven-eighths of an inch: head, with the back and sides of the neck, dark grey, having a black medial streak to each feather, most developed on those of the crown; ear-coverts forming a conspicuous deep rufous spot; shoulders of the wings, scapularies, and rump, the same but not so dark, also a band crossing the lower part of the breast, more or less developed; inter-scapularies or dorsal feathers resembling those of a male common House Sparrow; throat, fore-neck, and breast, to the rufous band, whitish or slightly yellowish-white, with a narrow black streak commencing at each corner of the lower mandible, widening or spreading as it descends, and then branching to form a gorget with its opposite, being more or less developed in different specimens; the sides of the breast, below this gorget are purer white, and the belly, below the rufous band, is tinged with fulvous; a light streak over the eye; wings dusky within, the feathers edged externally with rufous and fulvous, and the outermost tail-feather obliquely marked with white, the next but slightly so. Irides dark. Bill (at this season) dusky above, lighter on parts of the lower mandible; and feet pale brown with a slight livid cast. The female merely differs in being rather smaller with the colours less bright.

The only other Indian species we possess of this genus appears to have been several times described, firstly by Mr. Vigors, *(P. Z. S.* 1831, 183,*)* as *E. cristata,* then by Messrs. Jardine and Selby, (*Ill. Orn.* pl. CXXXII,) as *E. erythropterus,* and lastly by Mr. Hodgson, *(As. Res.* XIX, 157,*)* as *E. Nipalensis:* at least our specimens agree alike with all the descriptions here cited; and I even incline to doubt whether the *E. subcristata* of Col. Sykes, (*P. Z. S.* 1832, 93,) be aught else than the female, which opinion he indeed combats, albeit there would appear to be certain differences, to judge from his description.*

I have also obtained two curious small marsh birds in the bazaar, which are not easy to classify; being referriable, indeed, to an extensive group allied to the *Salicariæ,* to the *Priniæ,* and to that African subdivision formerly included in *Malurus,* and which group has not been, that I am aware of, duly studied in all its diversified ramifications. The first, however, I shall provisionally arrange as

Dasyornis? locustelloides, from the near resemblance which it bears in plumage to the Locustelle, or Grasshopper-bird, *(Locustella Raii,)* of the British Islands.† In form it appears to be closely allied to the *D. Australis* of Messrs. Jardine and Selby, figured in the "Illustrations of Ornithology," pl. LXXIII; but, on actual comparison, will probably prove separable as a minimum subdivision. Length seven inches, by nine inches in extent of wing, the latter from bend two inches and seven-eighths, and medial tail-feathers eight inches; bill to forehead (through the feathers) five-eighths of an inch, and nearly seven-eighths of an inch to gape; tarse an inch and one-sixteenth: the bill is strong, three-sixteenths of an inch deep, and compressed laterally, but otherwise resembles that of the *Salicariæ*, and between the rictus and eye are five remarkably strong bristles, forming an almost vertical range, with a small bare space in front of them, and they are curved stiffly outwards, as if the object were to defend the eyes; there are likewise small setæ at the base of the lower mandible: the wings and tail have also the true character stated of *Dasyornis*, as well as (it would appear) the feet. General colour olive-brown, with mesial blackish streaks to the feathers; the throat and belly white, and breast and flanks light brown, the breast having a few traces of darker specks: tail graduated, each feather tipped with fulvous-white, and the rest dusky along the centres, and brownish barred with dusky externally. Irides dark greyish olive. Bill dark olive-brown above, beneath paler; and legs light purplish-brown. The specimen described was a female.[*]

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* The Society has since received *E. citreola* from Mr. Hodgson.

† It is, I now find, the *Megalurus ? striatus* of Mr. Jerdon's Supplement, a single specimen having been procured by that naturalist on the Neilghierries.

The other species is considerably superior in size, with proportionally much larger and stouter legs, a straight and slender bill, and long, somewhat sharp-pointed tail, the feathers of which are exceedingly graduated; rictorial bristles small and inconspicuous. Its genus would seem to be *Megalurus*, and the specimen has unfortunately its wings and tail so much mutilated by the bazaar people, that I shall not offer a further description. A curious feature consisted in the inside of the mouth being wholly blackish, while the bill was of a livid colour suffused above with blackish, which is probably a seasonal distinction.

Cryptonyx coronatus: recent female, from Singapore, presented by myself.

The magnificent specimen of the Himalayan Lammergeyer *(Gypäetos)*, exhibited at the last Meeting of the Society, has been mounted, together with some other skins, and more are now in progress of being set up.

Recurring to the class of Mammalia, I noticed, in a previous Report *(ante*, pp. 95-8 *et seq.)*, the existence of three species of Otter in the Hooghly, in addition to a Darjeeling species there also described; and I may now announce the existence of a fourth species in the Hooghly, or at least which I infer to have been thence obtained, since our Museum contains two specimens of the skull, marked "common Otter," and which from their size I had hitherto referred to *Lutra leptonyx*. Upon recently, however, having had the skulls of *L. leptonyx* and *L. nair* taken out from the skins and cleaned, it became at once apparent that the species previously referred to the former was quite distinct, the skulls differing in being very much more compressed between the orbits, in the still inferior size although the age is greater, in the further development of the post-orbital processes in both specimens, and a variety of minor particulars. The difficulty of procuring specimens of these animals in this neighbourhood, however numerous they may be, is much greater than would be supposed, from the doltish apathy of the shikarees, who cannot be induced to deviate from their beaten path of procuring esculent creatures only; and it may yet be a long while, therefore, before I succeed in procuring the materials for describing the species which I have here merely indicated.

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[*] I have since obtained another species of the same minimum group, but so wretchedly mutilated by the bazar shikaree who caught it, and also smeared with bird-lime, that I can hardly venture upon a description. Not content with plucking out the large feathers of one wing and of the tail, the cruel brute had broken its lower mandible to prevent its biting, as is the custom of these people with Cormorants, Herons, and such other birds whose peck is worthy of some precaution to avoid: otherwise I think I might have kept it for a while alive. It is considerably larger than *D. locustelloides, (striatus,)* with legs proportionably larger, and the beak much less compressed laterally. Plumage very like that of the other, but a well developed whitish streak over the eye, the brown a shade less fulvous, and the blackish mesial streak to each coronal feather less defined and contrasting. Irides dusky olive: bill and inside of the mouth wholly blackish: and legs dull purplish-brown. Length, to *base of* tail, four inches and five-eighths, of wing three inches and a half, and tarse one inch and a quarter; bill to forehead (through the feathers) nine-sixteenths of an inch, and to gape, (which is armed with five strong outward-curved *setæ*, as in the other,) one inch and three-fourths. I shall provisionally designate this species *D. colluriceps.*—E. B.

A specimen of a Remora, or Sucking-fish, *(Echeneis naucrates,)* has been purchased in the bazaar.

My principal occupation has, however, been lately in arranging our shells, and especially our insects. Of the latter we possess, firstly, the specimens in the cases (including many from Assam and Sylhet), which were either merely arranged according to their localities, or not arranged at all; the former method possessing some advantages, but involving great inconvenience for room, and most unnecessary successions of duplicates of the generally predominant species : secondly, the box of Swan River specimens presented by Mr. Crichton, as noticed in my report for last September: thirdly, those from Afghanistan mentioned in my last report: fourthly, a considerable number that have been taken under my own superintendence in this neighbourhood : and fifthly, a large box of specimens, chiefly *Coleoptera* and *Hemiptera*, thrown loosely, upon one another, and consequently, for the most part, much injured, which were presented to the Society by Dr. O'Shaughnessy, and which I suspect (from the prevalence of certain species) to have been from Sylhet or Assam, probably the latter. Many interesting *Curculionidæ* and other hard-cased *Coleoptera* have been picked uninjured out of this lot, and altogether many hundred specimens have been rescued from impending destruction, affording a considerable number of duplicates of some of them, which are of essential service, as supplying the means of getting satisfactorily identified such as have already received names.

A package of various skins, chiefly of birds, has been shipped for the *Collegium Academicum* of Christiana; another to the Cornish institution at Truro, through Dr. Spry; and a third box of specimens has been forwarded to Mr. Jerdon at Madras, from whom, in return, we may expect, shortly, a consignment of valuable specimens from Peninsular India, whitherfrom at present our Museum can boast very few contributions in recent Zoology.*

I remain, Sir,
With much respect,
Your's obediently,
EDWARD BLYTH.

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* Mr. Jerdon's valuable donation has since been received.

Museum of Economic Geology.

Read report of the Curator in this Department for the Month of May last.

Report of the Curator Museum Economic Geology for the month of May.

Museum Economic Geology.—The Memoir alluded to in my last report, explaining briefly the object and wants of the institution, and soliciting contributions has been with the approbation of the Honourable the President and Secretary, printed, and is now on the table. It will be circulated as widely as possible in all the Presidencies, and in Europe, so as to insure us every chance of assistance.

I have resumed the arrangement of the Museum, and hope to get through with it, and the Catalogues shortly.

We are indebted to Mr. Hodgson of Nepal, for a small collection of iron, copper, and lead ores from Nepal, of which one or two are new to the Museum, and all valuable as contributing to our Indian series.*

Geological and Mineralogical.—We have at length to announce the arrival from Kemaon of three, out of five volumes of Captain Herbert's Journals, the remaining two being for the present with Mr. Batten, as explained in his letter.

Upon examining these volumes with reference to the collection in our cabinets, I find they relate first to from numbers 1 to about 375, then from 1 to 379 of the second thousand, and lastly from 1563 to 1612, leaving thus a blank of about 800 names and localities, which I doubt not, or at least I hope, will be found in the other books.

From a cursory examination of these volumes, I will venture to congratulate the Society very sincerely upon the amount of Geological and Mineralogical knowledge, which we have thus, I hope, obtained the means of giving to the world; (if we can but connect Captain Herbert's complicated systems of numbers,) and his friends upon the justice which these volumes will I trust enable us to do to his memory.

Major Manson who was Captain Herbert's Assistant, has been written to, to obtain any assistance which he can give us. We have received in this Department seven specimens (Geological) from Mr. H. Stanley. And I have been chiefly occupied in part with Captain Herbert's collections, and in part with our own Geological series.

H. PIDDINGTON.

Museum, 31st May, 1842.

Read letter from Mr. Secretary BUSHBY of the 2nd February 1842, forwarding a box of specimens of Magnetic Iron Ore, from Tavoy, Sulphuret of Antimony from the neighbourhood of Moulmein, and of the Mergui coal received from Captain TREMENHEERE.

An interesting Chart of the Barometrical curve, during the late storm, was exhibited to the Meeting by Mr. Piddington, who explained that he was in hopes of obtaining through the data he looked for from this storm, a Barometrical *measure* of the distance of the centre of a hurricane; which conjointly with the method of estimating the distance by mathematical projection, as given in his "Notes on the Law of Storms," published by Government for the use of the China Expedition, would enable the seaman to estimate pretty correctly his distance from the centres, and thus guide his judgment as to the best course to pursue.

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* I have to mention also, that permission has been obtained from Government to indent upon the Honorable Company's Dispensary, for such re-agents and apparatus as it may possess, which will be required for the Laboratory of the Museum.

For these presentations and contributions the thanks of the Society were accorded.

ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensgmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the

Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the remarkable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to the number at present only, we are able to estimate the riches of the whole creation, and to explain the alternations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°. with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

Herman von Meyer.

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JOURNAL

OF THE

ASIATIC SOCIETY.

A SIXTH *Memoir on the Law of Storms in India, being,* STORMS IN THE CHINA SEAS, FROM 1780 TO 1841. *By* HENRY PIDDINGTON.

It naturally occurred to me in the course of my investigations on this subject, that it would be of great interest could we collect together as many of the *old* storms of past years as remain upon record; and with this view, I addressed the Hon'ble the Court of Directors of the East India Company, requesting their assistance in obtaining from their official documents, and from their old officers, such information as still existed. With their wonted, and well-known liberality in the cause of science this request was promptly complied with, and I owe to their kind assistance a mass of documents, comprising numerous extracts from logs and letters which relate to the China Seas and Northern Pacific,* besides other miscellaneous information. It is then, I need not say, to them that this memoir will owe, in the first place, most of its information, and I may be allowed to add, that as the best thanks which I could offer to them, I have endeavoured to use to the best advantage their valuable materials.

To Captain Chas. Biden of Madras, I am next indebted for a long series of logs and notices, which he has been most zealous in collecting and forwarding to me. And from Mr. Greenlaw, the Secretary to the Marine Board, and Captain Clapperton, Acting Master Attendant at Calcutta, I have, as usual, received all the assistance they could afford: I must not omit to mention, that amongst several of the Hon'ble Company's retired officers who have given valuable notes, I am specially obliged to Mr. Thos. Packman, for some twenty pages of extracts and notices which he has been good enough to send me. I have been careful to note at the head of every storm the sources from which the documents are derived.

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* The remainder to the Bay of Bengal, Southern Indian Ocean, and Cape of Good Hope, which will appear in future memoirs.

It will perhaps be thought that I have here preserved some records which afford but scanty proof of the truth of the theory of storms as applied to the Chinas Seas; but it should be borne in mind that we have to prove, *first,* that the great storms are circular ones, or nearly so; *secondly,* that they turn from right to left outside; *thirdly,* that they are progressive; *fourthly,* the tracks on which they move; and *fifthly,* the rates at which they move, and any other peculiarities. Now to shew all this of any *one* storm, requires a considerable body of evidence, and such as can rarely be procured without great trouble and a fortunate combination of circumstances; but we may prove it little by little, and separately, of several storms; and above all, we may shew that *as far as all available record extends, there is no contradiction to the theory to be found!* and by publishing faithfully, make the data available for abler hands. With these views then, I shall I trust be acquitted of accumulating useless details, and I may add, that provided our data are but authentic, we can as yet scarcely say what may be, eventually, their relative importance.

TRACK No. I, 1780.

The first storm of which I have obtained any record is the following, from a note of Captain Biden's:—

An account of the distress of the London East Indiaman, 758 *tons, in a Hurricane on the Coast of China, in July last, taken from Captain* WEBB's *letter to the Directors of the East India Company. From the Annual Register.*—" On our arrival on the coast of China, off Macao, on July 17th 1780, after my packet was delivered to the supercargoes there, a tiffoon came on, which had very near demolished us.

"At four in the afternoon our best bower cable parted, and the ship cast in shore, but by setting all the sail I could, I just weared her clear of the land; and as the wind was then E. N. E. we stood out to the southward under our courses, and at six had the *Ladrones* bearing N. E. At eight the wind flew round to S. E. and blew the hardest gale I ever remember. We were then in twenty fathoms water, and not being able to make any more way out, our sails all blowing to pieces, we looked upon our destruction as inevitable, without a particular act of providence; for we were driving on a lee-shore. At twelve at night the wind flew to the south, its violence still continuing, and we found the ship shoaling her water, so that every soul on board was preparing for death. At daylight we were in twelve fathoms water, with the sea, which was as much mud as water, breaking entirely over us; we then threw some of our guns overboard, and cut away the main and mizen masts, and by the time we had cleared them we were in three fathoms water, the land only about a quarter of a mile distant. We immediately cut away the fore-yard and let go the sheet anchor, which, by the mercy of God, brought us up; and as the ship touched the ground abaft it eased her to the cable, or I am well assured the *Royal George's* anchors and cables would not have held her. We then instantly let go our spare anchor with a new cable, which parted as we were veering it out, so that we had no other left. About nine in the morning the gale abated. In the evening we hove up our sheet anchor, when we found the cable stranded. What saved the ship was the having all our guns housed, her ports in, and top-gallant masts down on deck, before the gale came on. Our drift in the gale was amazing.

"I imagined it at first only about fifty miles, but to my astonishment when the gale was over, I found myself as low down as Haynan, within the westernmost island, about 3 leagues from the continent. I must have passed in the night quite close to a rock that bore S. by W. when the ship brought up. The Chinese told me that every vessel that was that night at sea perished except mine, and that they had lost all their junks and boats round the whole country, and were certain not less than 100,000 people had perished in the storm.

"We had another tiffoon in August, when all the European ships at Wampoa drove with three anchors a-head. The Chinese junks and boats then in the river were most of them sunk, and the number of poor souls that perished in this hurricane is incredible. I repaired my damages as well as I could at Canton, but I was obliged to come away with only two cables."

Captain Biden's note upon this log, is as follows: "The extraordinary drift of the *London* from near Macao to the N.E. Coast of Hainan is worthy of remark. It appears she stood to the southward about four hours when the gale flew round from E. N. E. to S. E. Allowing her to have made thirty miles in those four hours; this ship must have experienced an amazing current to the S. S. W., the distance from the Grand Ladrone to Hainan, being about 180 miles, and much of the time the hurricane was from S. E. and S."—C. B.

It seems most probable, that this was a storm travelling along the South Coast of China, or from about E. N. E. to W. S. W., and that the *London* crossed its track, and not far from the centre, at 8 A. M. I have therefore laid it down as one of the probable tracks only, though from the ship's position, and the shift of wind being so well ascertained, we may infer that we are not far from the truth. The extraordinary drift would be quite incredible, did it not also rest upon good evidence, and it should be borne in mind by the seaman as at all events a possibility in like cases. It will be subsequently seen that in September 1803, the H. C. S. *Warley* was also driven from off St. John's to the Taya Islands, or about the same distance in about 56 hours, and that other instances of this dangerous storm-current have occurred.

1793.

On the 1st, 2nd, and 3rd of Dec. 1793, the Honorable Company's Ships *Royal Charlotte*, *Triton*, and *Warley*, bound to China, by copies of their logs received from the India House, were driven from Lat. 20° 9′ N., Long. 119° E.; to Lat. 17° 29′ N. Long. 116° 38′ E. or about 220 miles to the Southward and Westward by a heavy gale (called a Tyfoon in their logs) which began at North, veered to N. E. and N. N. E. and moderated again at North, veering when fine, to N. N. W. It is barely possible that this might have been a vortex travelling from the N. N. E. to the S. S. W. between the ships, and the Island of Luzon ; but I should be more inclined, at that season of the year, to consider it as what I have in my former memoirs styled a monsoon gale, i. e. the monsoon of the season rising to the height of a severe gale. Of this the reader will judge for himself. There is nothing in the data worth recording beyond the drift of the ships, and the steadiness of the wind during the storm, which was however so severe, that the *Royal Charlotte* lost her tiller, and the other ships several sails, &c.

TRACK No. II, 1797.

Narrative from Captain Lynns's Star Tables.

The *Duke of Buccleugh,* (burden 1182 tons), sailed from China (Macao roads), on the 15th June 1797, in company with His Majesty's ship *Swift,* Captain Hayward, and a fleet of sixteen ships.

Sunday the 18th June.—Moderate winds from S. S. E. to E. S. E., E., E.N.E., N.E. and North at noon, with hazy weather throughout. Latitude observed 21° 58′ N.; longitude per chronometer 116° 05′ E. Barometer 29° 15′. Thermometer 83°.

Monday, 19th June.—Commenced with increasing northerly wind and hazy weather; at 4 P. M. the wind increasing rapidly. In first and second reefs, handed the main-sail, struck the royal masts, and down top-gallant yards. At 7 P. M. wind N. E. by N., increasing to a heavy gale, handed the top-sails. From 9 P. M. till midnight, the wind veering from N. E. by N. to North, N. W. to West, S. W. and South, increasing gradually the whole time, when its force was tremendous, and such as no sail, I conceive, could have endured: the foresail at this time blew out of the bolt-rope to atoms, and the ship tried under bare poles until day-break, when the wind having veered to the eastward of South, began to abate. No ship in sight since 3 A. M. when the Commodore, with whom we had been scudding, and whom we knew by his top-light, bore E. S. E. a quarter of a mile, and suddenly disappeared. The sea during the height of the gale, (its surface being such a continued spray), it was impossible to face; it searched through the weather ports, although well lined and secured; and in the working of the ship through the weather seams, to such a degree, as was incredible. Notwithstanding the force of the wind, the sea was not near so high as in common gales of wind off the Cape of Good Hope, which I attribute to the partiality of the gale with regard to its extent, but perhaps to the extreme violence of the wind preventing the sea from forming a head. Bar. 29° 00′. Ther. 76°.

In this gale (we afterwards learned) the *Boddam* was totally dismasted, lost her bowsprit and rudder, and was towed into Macao road by the *Crescent* packet, where at anchor, this ship lost her foremast and bowsprit also. Latitude by account 22° 9′ North, Longitude 117° 3′ East.

Tuesday, 20*th.*—Wind from S. by E. to S.E. by S., gradually abating to a moderate breeze, with fine weather at noon, when the latitude was observed 22° 27′ N., and longitude by chronometer 117° 26′ E.

For the foregoing I am indebted to Captain Biden, and unfortunately amongst the logs from the India House, those relating to this storm are omitted, though the logs relating to two of the other storms experienced by the *Buccleugh* and fleet in the Northern Pacific have been sent me, and will appear in a memoir on the storms of that ocean. The only other record I have is a notice from memory from Mr. Baynes of Falmouth,* from which it appears, that the *Boddam* and *Chester* suffered severely in it, the former vessel being dismasted, with also the loss of her rudder. We have then to consider from this notice alone, what may probably have been the track of the storm.

Mr. Redfield in quoting this storm, seems to think that the true storm set in at North. I should scarcely think so from the terms of the log, and am inclined to take its commencement from the N. E. by N. wind, at seven P. M. when the ship drifting across the track of the storm within, a short distance of its centre, will account for its veering, taking the track to be about an East and West one.

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* India House Memoranda.

There is however another and a more probable reason to account for the slight anomaly, taking the storm to have begun at noon, and from the North, as Mr. Redfield supposes, which is, that at this time the *Buccleugh* was only 50 miles from the coast of China, which being high, would, as we positively know in the case of the storms of the Bay of Bengal, occasion variations in the direction of the wind, and probably influence that of the centre itself. We cannot venture upon such slender data to mark any thing more than a conjectural track for this storm on our chart, but we may be satisfied that it travelled from the Eastward towards the West, and veered according to the Law of Storms in the Northern hemisphere.

TRACKS No. III. and IV.—September 20th to 23rd, 1803.

Documents from the India House and Captain Biden.

On the 20th to 23d of September, 1803, a fleet of the Hon'ble Company's ships, consisting of the *Warley, Royal George, Bombay Castle, Alfred, Coutts, Earl Camden,* and *Ganges,* experienced two very severe tyfoons in the China Seas. Of these ships, the first three, viz. *Warley, Royal George,* and *Alfred,* were close in with the Coast of China, and some of them were anchored off St. John's, while the last four, *Coutts, Earl Camden, Bombay Castle* and *Ganges,* were about latitude 16° N. and thus at least 6° South of the others. We should have then consequently, as it were, two fleets on opposite sides of a great storm of 6° of latitude, or say 400 miles if it was one storm, or if there were two, the two fleets still serve to define their tracks and limits. I shall subsequently give a full detail of how they do so.

My authorities are the logs of the ships from the East India House, from Captain Biden, who was a Midshipman in the *Royal George,* and the log of that ship, with a private memorandum of Captain Torin's of the *Coutts.* I commence with the logs of the ships off the Coast of China, reducing them to civil time.

No. 1.—*Abridged Log of the Honorable Company's Ship* WARLEY; *reduced to civil time.*

The Honorable Company's Ship *Warley* was on the 21st September, at noon, in lat. 21° 17′ N., long. 113° 7′ E. with the land about St. John's and the Madarin's Cap in sight at sunset; blowing fresh from N. N. E. to N. by W. at midnight, when she was in twenty-five fathoms water.

22nd September.—From midnight to noon, wind increasing fast, ship standing in to the N. E. and East with wind as before, and N. by W. at noon, when she was in thirty fathoms water off St. John's, about lat. 21° 10′ N. long. 112° 48′ E. By 11 P. M. all the storm staysails blown away; wind apparently steady from the North and N. N. E., though not marked in this log; ship hove to with her head to the Eastward.

23rd September.—Storm increasing, top-masts blown away, ship becoming almost unmanageable; at a little after noon, when by indifferent observation the latitude was 21° 15′ N. they let go the best bower anchor, to try to keep the ship's head to the sea; the wind is not marked, but seems to have been about E. by S. at noon.

24th September.—Rolled away the mizen-mast. Saw the Taya Islands at 6 A. M. Latitude at noon 20° 15′ N.

With reference to the log of the *London* at p. 607 it will be seen, that this is another instance of a ship's being blown and drifted from the mouth of Canton river to the Coast of Hainan, in about fifty-six hours.

No. 2.—*Abridged Log of H. C. S.* ROYAL GEORGE, *Captain J. F. Timins, reduced to civil time.*

The *Royal George* was, at noon on the 22d September, at anchor, with the Grand Ladrone bearing N. by E. ¾ E. three or four miles, and the Asses' Ears E. by N., strong gales from N., with squalls and hazy weather, lat. 21° 50′ N. P. M. hard gales with squalls and fair weather. Wind N. N. E. at 5 P. M. and N. E. at 9; midnight, severe gusts of wind with rain, and a heavy swell from the N. E.

23rd September.—A. M. very hard gales with severe gusts of wind and rain, veering away cable.

At 2 A.M. the wind marked E. N. E. At 3, blowing very hard, cut the cable and hove to (head to the S. E.) under bare poles. P. M. wind East, strong gales with heavy squalls Southerly. More moderate from 3 P. M. At 5 P. M. St. John's bearing W. N. W. three or four leagues, in twenty fathom water.

24th September.—At 8 A. M. St. John's bearing N. W. six or seven leagues; Cow Cock N. E. by N., wind E. by S. making sail. The *Alfred* at daylight S. by E. five miles.

No. 3.—Abridged Log of H. C. S. ALFRED ; *reduced to civil time.*

At noon *22nd September,* had the Grand Ladrone bearing W. ½ S. Gap Rock South, and Asses' Ears due East. Observed that the swell was rising from the Eastward. Wind marked North. At noon working in to the anchorage; P. M. increasing breeze and cloudy weather, with a long swell from the East. At 4 P. M. anchored with Grand Ladrone bearing S.; Gap Rock S. by E.; Asses' Ears S. 65° E. making all snug. At 11 P. M. wind increased to hard gale N. N. E. At midnight drove.

23rd September.—Gale still freshening, and ship driving at the rate of 2½ knots per hour, cut and stood to sea, hove to at 2 A. M. Wind at N. E. and at 4 at E. N. E., heavy gale with hard squalls and a confused sea at noon. At 2 P. M. E. S. E. At 4 made some sail. At 7 P. M. E. S. E.

24th September.—*Royal George* at daylight N. by W. Wind about E. S. E. and moderating.

No. 4.—Abridged Log of the EARL CAMDEN, *Captain Dance ; reduced to civil time.*

Wednesday, 20th September.—Noon lat. 15° 42′ N., longitude 113° 41′, hard gales with squally weather, wind N. N. E. at 1 P.M. At 3

N. by E. At 5 N. by W. to midnight; ship trying to the N. E. by E. but making little or no way.

21*st September.*—Constant hard gales, and thick squally weather continue with a high confused sea. 2 A. M. wind N.N.W. At 3 N. W. b N. At 9, N. W. by W., 11 A. M. N. W. hove to under close reefed main top-sail, lat. 15° 51′ N., longitude 115° 27′ E. *Bombay Castle* in company, P. M. wind W. N. W. hard squalls, thick weather, and rain throughout till midnight.

22*d September.*—1 A. M. Wind West. At Noon S. W. by S. lat. 16° 17′ N., longitude 116° 23′ E. P. M. wind S. W. by S. At 5 P. M. wind South, bore up. At 7 P. M. wind S. W. At midnight S. S. W. weather moderating since noon.

23*d September.*—Monsoon weather; wind from S. to S. S. W., ship going four and five knots to the N. by W. Noon, lat. obs. 17° 01′ North, longitude 114° 4′ E.; from which time fine weather to China.

No. 5.—Abridged Log of the H. C. S. BOMBAY CASTLE, *Capt. Archibald Hamilton; reduced to civil time.*

In this ship's log there are no latitudes or longitudes marked, but as she was for the first part of the storm within a few miles of the *Camden,* we may thus take it as corroborative of that vessel's well-kept record. The ships seem to have been driven to the Southward, (they were bound *to* China it will be remembered), by the continuance of a northerly wind, which indeed is not uncommon at this season, and may be the first struggles of that part of the trade wind which constitutes the N. E. monsoon, to overcome the South-westerly one; and thus, if we admit mere dynamical causes to originate these verticæ, giving the first impulse to them, for by a memorandum in the log, they were on the 19*th September,* in latitude 16° 2′. The *Camden's* log giving 15° 42′ for the observation of the 26th.

20*th September.*—P. M. Wind N. N. E. strong gale and cloudy to midnight, ship under close reefed top-sails.

21*st September.*—3 A.M. N. N. W. Noon N.W. b N. preparing for bad weather, blowing very hard with violent squalls and heavy head sea. At 4 P. M. lying to under mizen stay-sail. At 6, wind NW.

22nd September.—7 A.M. Wind S.W. b W. Noon about S.W. b W. hard squalls. P.M. S.W. b W. at half past 3 more moderate. At 5. S.W. bore up. At 8, *Camden* N. E. 3 miles; at 10, S. W. b S. moderating as with the *Camden* to S. by E. at 7 A. M. and to midnight.

24th September.—Fine wind. In company with the *Camden.* At 11 A. M. on 24th, saw the *Coutts* under jury-masts, and without a bowsprit.

No. 6.—Abridged Log of the H. C. S. GANGES, *Captain Moffat, reduced to civil time.*

20th September.—At noon Lat. 16° 59′ N. Long. 114° 53′ E. wind N.E. by N. Hard gales, severe squalls and thick weather till midnight. Ship standing to the Eastward under treble-reefed top-sails.

21st September.—At 1 A.M. the wind, from the courses marked was N.½W. and N. b W. at 3, continuing till noon when veering to N.N.W. At noon hove to with wind marked N. W. b N. At 1 P.M. under storm stay-sails, the *Coutts* bearing E.S.E. Latitude by indifferent observation and by double altitudes 16° 41′. Longitude per Chron. 116° 31′ E. P.M. wind N.W. by N. drawing round at times, as appears by the log, (for the wind is not marked, and this is deduced from her coming up and falling off,) to W. N. W. By midnight wind increasing to a heavy storm. At 5 P.M. lost sight of the *Coutts.* Staysails blowing to pieces between this time and midnight.

22nd September.—At 6 A.M. wind about West, and at 9, W.S.W. At noon wind about S.W. by W. blowing a violent hurricane, ship lying to under the storm mizen only, weather so thick with drift and haze cannot see a ship's length a-head. Lat. double altitude 16° 17½′ longitude per Chron. 117° 17′, find the drift made by time-keeper from noon yesterday S. E. by E. ½ E. 50 miles. P. M. wind marked as S. W. blowing a violent hurricane, ship lying to under storm mizen staysail and falling off into the trough of a very heavy sea, made sail and bore away. At 4 P. M. steering N.W. to save the masts. At ½ past 5, the fore and main staysails blowing to atoms, got tarpaulins and boats' sails lashed in the weather fore-rigging to keep the ship off the wind, which however aided very little till 9 P. M. when the storm began to abate;

wind not marked, ship running N.W. 27 miles till 8 P.M. then N.N.W. 14 miles till 10, and N. by W. 13 miles till midnight.

23rd September.—Wind more moderate, able to steer the ship with safety, though rolling very deep. Steering North 66½ miles, till noon, wind not marked at noon, but S. E. at 1 P. M. At noon weather moderate, heavy confused sea, rolling gunwales in, Latitude 18° 58′ N. longitude by chronometer 117° 45′. Ship having made a course of N. ¾ E. 143 miles since yesterday. P. M. wind S. E. and E. S. E. At 10 P. M. a four knot breeze, the weather having cleared up.

Noon *24th*—Latitude 20° 40′ N., longitude 117° 41′ E.

No. 7.—Abridged Log of the H. C. S. COUTTS, *Captain Torin, reduced to civil time.*

20th September.—Latitude noted as 16° 57′ N.

21st September.—P. M. when the log commences, wind marked N. W. by N., hard gales with heavy squalls and a large confused sea. At 10 P. M. wind W. N. W. under fore-sail and mizen stay-sail with head to the North.

22nd September.—At 5 A. M. wind West, hard squalls. At 6, marked W.S.W. and at 7, S.S.W. In the observations it is said that at 9 A.M. the wind shifted to the S.W. and moderated until near noon, when it came on to blow again very hard with heavy squalls and rain. No observation or account marked in the log. 1 P. M. wind S.S.W. hard gale increasing to a most violent tyfoon with rain, *lightning,** and a large confused sea. At 4 P.M. the wind S.S.W. weather fine, shrouds giving way, bore away to save the masts, lost fore-topmast; 7 P.M. lost fore-sail and broached to. At 8, main topmast blew away, at 9, lost the main and mizen masts. At 10, wind marked as South, and at 11, S. by E. Lost the bowsprit.

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* The only instance in which lightning is marked in any of the logs of this storm, and therefore probably the only instance in which it occurred; for seamen rarely omit noticing it, particularly in heavy weather, to which it gives such an awful appearance.

23rd September.—2 A. M. lost the spare and stream anchors. At 3, the foremast fell into the waist. At daylight moderate; clearing the wreck, and by noon kept on her course under a jury mast. Latitude observed 18° 08′ N. Longitude by Captain Torin's private journal 117° 14′, Wind S. by W. at 1 P. M. when moderate breezes and fair weather. Wind S. S. E. at 10 P. M. and till midnight.

24th September.—At ½ past 8, saw two sail to the South, *Camden* and *Bombay Castle.* At noon one ship, (*Camden*) two miles astern. Latitude observed 18° 51′ N. Longitude 116° 52′ E.

To place our deductions from the valuable records of this storm, or storms, in a clear light, I shall preface them, as in my former memoirs, with a synoptical table, shewing for each day the relative positions of the ships, and briefly the weather they experienced.

Tabular View of the Tyfoon of 20th to 23d September, 1803, in the China Seas.

Date, Civil time.	Ship's Name.	Winds and Weather.	Lat. N.	Long. E.	Remarks.
			° ′	° ′	
Noon 20th, Sept. 1803.	Earl Camden, ..	N. N. E. hard gales and squally, ...	15 42	113 41	Increasing and veering to N. by W. by midnight and N. W. by noon on 22d.
	Bombay Castle, ..	N. N. E. strong gales and cloudy.	15 42	113 43	In company with the Camden, winds the same. Lat. on 19th 16° 2′ N.
	Ganges, ...	N. E. by N. hard gales Noon squalls and thick weather, ...	16 59	114 53	Standing to the eastward, wind veering to N. ½ W. by midnight, and N. N. W. by noon next day. Coutts in company.
	Coutts, ...	.. .. ..	16 57	.. ..	No Log for this day, but in company with Ganges.
	Warley, ... Royal George, .. Alfred, ...	Fine weather, ...	.. ..	.. ..	No Logs for these days, the storm not having commenced with these ships, which were standing in for the Coast of China.
Noon 21st Sept. 1803.	Earl Camden, ..	N. W. hard gales, thick squally weather and high sea, ...	15 51	115 27	Wind veering to W.N.W. P.M. and to the westward A.M. 22nd; Bombay Castle in company at noon. Hove to under close reefed main topsail.
	Bombay Castle ..	N. W. by N. blowing very hard with violent squalls,	.. ..	.. ..	In company with the Camden.
	Ganges, ...	N. W. by N. hard gales, thick weather and rain,	16 41	116 31	Noon hove to under storm staysails, wind drawing gradually more westerly & increasing. Coutts in company till 5 P. M.
	Coutts, ...	N. W. by N. The same weather and position, ..	.. ..	.. ..	10 P. M. wind W. N. W.
	Warley, ...	N. N. E. to N. by W. At midnight blowing fresh,	21 17	113 7	Working in towards the Coast of China.
	Royal George, ..	No log for this day, ..	.. ..	.. ..	These two ships I suppose had fine weather with a fresh breeze, as their logs of 22nd begin with the same.
	Alfred, ... :	No log, ...	.. ..	.. ..	

Date, Civil time.	Ship's Name.	Wind and Weather.	Lat. N. ° ′	Long. E. ° ′	Remarks.
Noon 22d, Sept. 1803.	Earl Camden, ..	About S. W. storm continues, ...	16 17	116 23	Hove to under storm staysails. Wind has drawn from West at 1 A. M. to SWbS. at noon and South, at 5 P. M. W. S. at 7 after bearing up, and midnight S. S. W. Moderating since noon.
	Bombay Castle, ..	About S. W. by W. the same, ...	.. ..	.. ..	Noon, Camden East 3 miles; at 5, bore up, wind S. W. and S. by E. at daylight.
	Ganges, ...	About S. W. by W. blowing a violent hurricane, thick weather, ...	16 17½	117 17	Excessively thick weather, wind has veered from West at 6 A. M. to S. W. by W. at noon & S. W. P. M., Bore up at 4 P. M. to save the masts.
	Coutts, ...	About S. W. by W. increasing to a violent tyfoon.	.. ..	near the Ganges till 4 P.M.	Rain and lightning; 4 P. M., bore away N. N. W. ½ W. with wind S. S. W. ship dismasted by midnight.
	Warley, ...	N. by W. increasing fast,	.. ..	.. ..	By 11 P. M. all the storm staysails blown away.
	Royal George, ..	North, strong gales, ..	21 50	.. ..	At anchor off the Grand Ladrone P. M. increasing fast. Wind N.N.E. at 5 P. M.; N.E. at 9 and to midnight.
	Alfred, ...	North, ...	.. ..	.. ..	Grand Ladrone W. ½ S. swell increasing fast from eastward, working into the anchorage. 4 P. M., anchored 11 P. M. hard gale N. N. E.
Noon 23d, Sept. 1803.	Earl Camden, ..	S. to S. S. W. fine, S.b E. at noon, ...	17 01	117 12	Steering to the North 4 and 5 knots.
	Bombay Castle, ..	As with Camden, ...	.. ..	.. ..	
	Ganges	About S. E. moderate, ..	18 58	117 45	Very heavy and confused sea P. M. wind S. E. and E. S. E.
	Coutts, ...	S by W. at 1 P.M. moderate,	18 8	117 14	Veering to S. S. E. at 10 P. M.
	Warley...	About E. by S. (but not marked) blowing very hard,	21 15	.. ..	Furious gale, topmasts blowing away, and anchors washed overboard; P. M. veering to S. Eastward.
	Royal George, ..	About East or E. b N. (1 P. M. East) the same weather..	.. ..	.. ..	Strong gales, but moderating from 3 P. M.

Date, Civil time.	Ship's Name.	Wind and Weather.	Lat. N.	Long. E.	Remarks
			° '	° '	
Noon 24th, Sept. 1803.	Alfred, ...	About E. by S. (E. S. E. at 2 P. M.)	.. ..	.. ..	Strong gales, at 4 P. M. made sail.
	Earl Camden, Bombay Castle,	Fine, all sail set, ...	18 48	116 9	
	Ganges, ...	Fine, the same, ...	20 40	117 41	Sea very irregular, steering to the N. N. W. since daylight.
	Coutts, ...	Fair, light winds from S. E., E. S. E.	18 51	.. .	
	Warley, ...	Just making sail. Wind not marked, supposed S. to S. S E.	20 15	.. ..	
	Royal George, .. Alfred, ...	Fine, ...			

I now proceed to the deductions to be drawn from the foregoing documents, but before I do so, I should remark, for the information of those unacquainted with the fact, that the East India Company's China ships were, though merchantmen, vessels of from 12 to 1400 tons, mounting upwards of thirty guns, with crews and officers in proportion, and these last in their day, men of the first acquirements and talents in their profession. When we find, therefore, that such ships, well found and managed as they were, suffered so much from the storm, we must recollect that their logs express pretty nearly what a good Frigate or sixty-four gun ship of the old times, would have found it: Weather in which smaller merchant vessels would have been reduced much sooner to bare poles.

It is evident from the inspection of the tables, that one of the storms was travelling from the South-eastward to the North-westward, for it began on the 20th with the *Camden, Bombay Castle, Ganges,* and *Coutts* close to the Eastern edge of the Macclesfield bank, six degrees South of the entrance of Canton river, while near the Coast of China, the ships were standing in for it with fine weather.

The table of the 20th, it will be seen, gives two directions of the wind for the Southern storm, N. N. E. for the *Camden* and *Bombay,* and N. E. by N. for the *Ganges.* Taking these as tangents, and projecting carefully for the centre of the storm from the ships' positions, they will be found to place it about the Island of Mindoro, or S. E. by E. ½ E. of the ships, distance 380 miles. Perhaps the centre was not really so far off, as, the angle being so acute, considerable error may occur, but this is quite evidence enough to show, that the storm *did* commence to the E. S. E. of this part of the Fleet. I have not therefore marked a centre for this day, but carried the Track from that quarter.

On the 21st, there was still fine weather on the Coast of China, but with the southern division of the fleet, the storm by noon was so heavy as to bring them under close reefed top-sails with top-gallant masts and yards down, and all other preparations for bad weather. It should be noticed that these four ships of the southern division form again two smaller divisions. The *Camden* and *Bombay Castle* together, being just to the Eastward of the Macclesfield, and the *Ganges* and *Coutts,* also in company with each other, about eighty miles to the E. N. E.

of them. The winds marked in these ships' logs* both place the *centre* to the N. E. b E. of them, and as we have no cross bearing by which to lay down the distance of it, we can only do so by judging of the force of the wind, and its veering; which with the ship farthest to the Eastward, the *Ganges*, (for we have not the log of the *Coutts* for this day, though we know she was in company with the *Ganges*) was not quick; the wind having remained about N. W. by N. from midnight. Allowing then for the ship's drift, and for the increasing violence of the storm on the 22d, I have placed the centre at noon this day in latitude 17° 36′ N. longitude 118° E.

For the 22d, we find, that to midnight on the 21st, and to 5 A. M., on the 22d, and with the *Ganges* and *Coutts*, the wind held steady to the N. W. when it drew round to West and S. W. at noon. The log of the *Bombay Castle* shews nearly the same veering, but that of the *Camden*, marks the wind at West at 1 A. M.; and the *Bombay Castle*, from her coming up to N. N. W. at 3 A. M., appears to have had the wind also not far from West at this time, though both ships' logs agree nearly enough at noon; when the *Camden* seems to have had it S. W. by S., and *Bombay* about S. W., *Ganges* about S. W. and *Coutts* S. S. W. as far as can be judged from their logs. The drift of these two last vessels is laid down for the twenty-four hours between noon, 21st and 22d in the *Ganges'* log, which is most carefully kept,† as S. E. by E. ½ E. fifty miles.

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* I may notice here in strong corroboration of many of my remarks in these memoirs, the difficulty of analysing a storm from the direction of the wind considered as a tangent line to the supposed circle of it, and the ship's position as the point at which the tangent touches the circle. Thus we have, in the logs of the *Camden* and *Bombay Castle*, within three miles of each other, the wind marked as follows · for the 21st *Camden* at 2 A.M. N. N. W., *Bombay Castle* at 3, N. N. W. *Camden* at 3, N. W. by N. *Camden* at 9, N. W. by W.; at 11 N. W. *Bombay Castle* at noon N. W. by N. and at 1 P.M. N. W. by N. *Camden* at 1 P.M. W. N. W. *Bombay Castle* (hove to) at 6, wind N. W. and so forth. It is clear that these variations arise partly from carelessness, and partly from errors in judgment in such severe weather. I shall perhaps be told here that I am looking for mathematical exactness where none can exist. I am, I own, seeking for all the exactness which can be obtained, and I desire that all our evidence should be fairly brought forward on this most important question, that it may be impartially weighed by all as well as by ourselves, and that we may not be said to have assumed any thing without giving our grounds for so doing.

† With the exception of the direction of the wind which is very frequently omitted either in the log, or by the copyist.

Now this circumstance of the wind holding steady to the N. W. for seventeen hours, and then veering rapidly, or within about eight hours, the remaining eight points, or a point an hour, till it reached the S.W. is worthy of note; particularly if we look at the drift of the vessels to the E. S. E. and N. E., according to their logs, (though in these there are some slight discrepancies and omissions, and some apparent assumptions,*) and remark the increased violence of the wind before and after noon on this day, shewing either that the storm had been really now forming, or stationary, or curving as I have laid it down. Giving this every consideration I cannot avoid concluding, that the storm, which had apparently come up from the S. E. by E., under the lee of the island of Luconia, having arrived opposite the great opening to the Pacific Ocean curved to the Westward, as I have marked it, in its progress over to the entrance of the Gulf of Tonkin; influenced perhaps by the prevalence of a N. E. wind from the Pacific. The circumstance of its altering its direction so considerably from that which it had under the lee of the very high land of Luzon, is not more extraordinary than the curves which, we know, occur in the Western hemisphere, and some about the Isle of France in our own. The storm indeed may have been really a Pacific Ocean storm, forcing its way across Luconia, from the coast of which the ships were but little more than 200 miles distant? If this was the case, we may suppose the anomaly easily accounted for. I have then, on these considerations, marked the centre for the 22d, as in latitude 17° 20′, longitude 115° 16′ E. and bearing N.W. by W. ½ W. from the *Ganges* and *Coutts*, (which had the wind from S. W. by S. and S. S. W.) and N. W. from the *Camden* and *Bombay*, which had the wind S. W. by W. and S. W. by S. We have still the anomaly, that the *Coutts* and *Ganges*, seem, by the expressions used in the logs, to have had the wind more violent than the *Camden* and *Bombay*, but I suspect that these latter ships were really much farther to the S. E. than their positions shew, for the wind was from W. N. W. and West the greater part of the twenty-four hours, and their drift made good in such weather, could scarcely be better than East at most. I have however given the evidence as it stands.

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* Such as longitude marked "by chronometer" on the noon of the 22d. In weather like that then prevailing very little dependence can be placed on sights for chronometer or double altitudes, for it is said, "at noon blowing a violent hurricane, weather so thick with the haze and drift cannot see a ship's length a head. What is meant is probably the chronometer brought on by dead reckoning, but this should be noticed.

For the centre of the 23d we find that the *Coutts*, bearing up with the wind at S. S. W. a little after noon on the 22d, was utterly dismasted by the violence of the hurricane, by 4 A. M. on the 23d, and that at daylight it was moderating. She steered N. N. W. ½ W. when she bore up, and ran for 31 miles on this course before she broached to. The centre of the hurricane bore at noon 22d, as we have shown, about N. W. by W. ½ W. from her, and it was certainly travelling to the westward, so that the *Coutts*, steering N. N. W. ½ W. and drifting when dismasted between W. S. W. and W. N. W. was pretty nearly *chasing* it! and its rate of travelling does not seem to have been high. The *Ganges* also bore away, but two hours later, and she fortunately did not reach so far towards the centre as the *Coutts*. The storm, as I have remarked, does not seem to have moderated till about day-light, on the 23d, with the *Coutts*, while it moderates at 9 P. M., on the 22d with the *Ganges*. I have taken the centre of this day, the 23rd, to be in about lat. 17° 40′ N., long. 112° E.

The *Camden* and *Bombay Castle* also bore up about 3 P. M., but as they were going only four-half and five knots, and had the weather moderating from that time, they may almost be considered as out of the storm.

If we now refer back to the table and logs, we shall find that between noon and midnight of the 22d, the wind on the Coast of China was setting in for a gale there, which may be fairly said to have begun at 10 A. M. on the 22d, with the *Warley*, which ship was then about on the meridian of St. John's, in thirty fathoms, or twenty five miles off shore.

She had the wind at N. by W., and with but little variation it continued to hang about thus, or North, (judging from her coming up and falling off,) till 4 A.M. on the 23d.

With the *Royal George*, at anchor under the lee of the Grand Ladrone, it also may be said to have commenced at the same time. She marks the wind at North, and the *Alfred*, at anchor farther in amongst the shelter of the Islands, had the swell rising from the

Eastward, and the wind North increasing to hard gale at N. N. E. at midnight, when she cut and stood to sea.

With every allowance for the effect of the high land on the vortex, we cannot I think suppose this storm to be the same, which was also at noon on the 22d blowing with such fury from S. W. by W., as to dismast the *Coutts*, &c. a few hours later; for the centre of the southern storm by 3 P. M. must have been bearing S. by E., at most, if not South from the Grand Ladrone, which, if the storms were the same, would make the wind *East* then; and it was not even E. N. E. with the *Alfred* and *Royal George*, till about 3 A. M. on the 23d, or 15 hours later! I think this a convincing proof that there were two storms, and have therefore laid down two Tracks for them, taking the northern storm to have travelled from the N. 62° E. to the S. 62° W. at about 60 or 70 miles distance from the coast, which will be found to agree well with the logs of the ships, though there may be some discrepancy with that of the *Warley*, but, first, we can only guess at the wind, from her coming up and falling off, next she was nearly or quite unmanageable, and lastly she was half embayed in the gulf between the N. E. point of Hainan and the coast of China, where the storm must have felt the effect of the high land on both sides.

The rate of travelling of these two storms is next to be considered. We can hardly assign any fixed centre for the Southern storm on the 20th, though we know the direction in which it lay, those of the 21st, 22nd, and 23rd, however, are sufficiently ascertained, I think, for us to suppose that the storm may have travelled about 150 miles between the 21st and 22nd, and about 180 miles between the 22nd and 23rd. We may allow a mean rate of about seven miles per hour, or 168 miles in the 24 hours, for these two days.

For the Northern storm we can scarcely assign any rate, for the distance of the centre on the 22nd is quite uncertain, as it is also on the 24th, so that we have no data for it. Taking about the same rate, as that of the Southern storm, or 168 miles per day, it will however, be seen, that this is not an improbable one for it.

I trust that those who may have followed me in this, perhaps somewhat prolix, detail, will remember, that I have given it for the purpose of showing how I have taken the evidence before us; for we have no right to lay down tracks for storms, however well *we* may be satisfied that they are not far from the truth, without also shewing, for the use of others, how we arrive at our conclusions. Both storms tending as they evidently did to the Southern entrance of the Gulf of Tonkin, formed there on their South-western quadrants one of the "heavy N. W. storms blowing out of the Gulf of Tonkin," of which Horsburgh speaks. There were no Barometers apparently with any of these ships.

TRACK No. V.—1809.

The TRUE BRITON'S *Storm.*

Documents from the India House.

On the 28th and 29th September, 1809, the Hon'ble Company's ships *True Briton, Scaleby Castle, Cumberland* and *Neptune,* experienced a tremendous tyfoon, between latitudes 20° and 21° North, and longitudes 113° and 114° East, or about 100 miles from the Coast of China, in which the *True Briton* foundered, and the other ships experienced severe damage. I abridge here, first, the logs of the ships, and then, placing them in the tabular form, shall make a few observations to explain the deductions from which I have laid down the Track of the storm.

Abridged Log H. C. S. CUMBERLAND, *Capt. Wedderburn, reduced to civil time.*

27th September.—At noon in latitude 19° 47′ N., mean longitude of the fleet 114° 43′ E. Light airs from N. N. E. to West till midnight; the fleet in company. Much lightning to the Westward. Standing to the Northward; wind West at midnight.

28th September.—At 9 A. M. wind from N. N. W., fleet standing to the North Eastward, four and five knots. At noon, latitude by account of the fleet 20° 51′, longitude of the fleet 114° 54′ E. Barometer 29.13. Thermometer 81°, freshening, cloudy and squally. P.M. a very hard gale from N. N. W.; veering at 9 P. M. to N. N. E. blowing during the night, "with inconceivable fury;" the boats, the fore-sail and other sails blowing away piecemeal at midnight.

29th September.—Weather continuing, lost the small bower anchor, ship under bare poles at 2 A. M. At 10 A. M. wind S. E. At noon latitude 20° 33′, longitude 114° 54′. Barometer 28.65. Thermometer 81°, P. M. wind E. S. E., at 11, East.

30th September.—Moderating apparently about midnight, but the log very imperfectly kept. 9 A. M. wind S. E. by E. Noon latitude 20° 58′ N., longitude 112° 15.′ Barometer 29.20. Thermometer 79°.

1st October.—" No observation," is the only record given for this day, by an oversight of the copyist no doubt.

Abridged Log of the H. C. S. SCALEBY CASTLE, *Captain John Loch, reduced to civil time.*

27th September, 1809.—At noon in latitude 19° 48′, mean longitude 114° 43′. 5 P. M. light airs and calm at midnight.

28th September.—A. M. " the weather with rather a threatening appearance, though the Barometer has not fallen a great deal." At noon it is remarked again: " The Barometer fell in the last 12 hours from 29.85 to 29.50, but after the gale commenced, it fell very fast." At noon lat. 20° 55′ long. 114° 54′, wind N. N. W. P. M. N. N. W. to N. b E. at 10 P. M. From noon the gale freshened with squalls; by 2 P. M. a fresh gale, 5 P. M. blowing very hard, and by 9, "a most tremendous hurricane." At midnight boats and sails blowing away, wind marked N. E. by N.

29th September.—1 A. M. wind East, at 5 E. S. E., at noon not marked. Of the Barometer it is said: " The Marine Barometer began " to fall fast after 4 P. M. but before that it was not very low. Towards " midnight it had fallen to 28.30, where it continued for near 24 hours. " This was the lowest I ever saw the Barometer. The hardest of the " gale was about 2 A. M. Noon lat. account 20° 26′, long. account " 114° 37′ E., wind E. S. E." Violent gale still continuing with a high sea, but began to moderate towards noon. At 5 P. M. saw a ship bearing East, with loss of mizen-mast and fore top-mast, which is supposed to be the *Neptune.* Wind E. S. E., At midnight hard squalls, ship lying to; wind S. E. since 9 P. M.

30th September.—Wind S. E. at day-light, and till noon. " The Barometer began to rise after daylight." Noon, latitude account 20° 21′

longitude chronometer 111° 34′, shewing *a difference of* 111 *miles! from the longitude by account.*

1*st October*.—No log given.

Abridged Log of the H. C. S. NEPTUNE, *Captain W. Donaldson, reduced to civil time.*

27*th September*.—Noon latitude 19° 51′; in company with the fleet, winds variable and calm at midnight.

28*th September*.—At 4 A. M. lightning to the N. W., at 6 W. N. W., at noon no observation, but latitude and longitude nearly that of the other ships being in company. At noon a fresh breeze with thick rainy weather, increasing at 1 P. M. to a fresh gale N. N. W. At 5, hove to under storm stay-sails, wind North. At 6, the fleet pretty close, dark gloomy weather, gale increasing fast, with a heavy cross sea striking the ship very hard; at half-past eight, lost the mizen mast, wind about N. E. at midnight.

29*th September*.—At 4 A. M. wind East with violent gusts; at 6, E. S. E. lost fore topmast, got the main yard on deck; at noon wind about S. E. by E. Noon no observation. P. M. wind S. E. by E. Hard gales, thick weather and high sea; all hands at the pumps; at 10 P. M. wind S. E. to midnight.*

30*th September*.—A. M. wind S. E. at 10 S. E. by S., ship on her beam ends throughout the storm. Noon no observation. P. M. S. E. hard gales till midnight, when moderating.

1*st October*.—8 A. M. wind S. E. wore and made some sail at daylight; 12 hours log only given. At noon, latitude by indifferent observation 20° 48′ N.

A letter from J. B. Burnett, Esq. a Midshipman in the *Scaleby Castle* at the time of this storm, is also added to the documents from the India House, as follows. It is dated Monboddo, 6th November, 1841:—

"The account of that remarkable tyfoon, in which the *True Briton* perished, lies before me. I was then a Midshipman in the *Scaleby Castle;* the *True Briton, Neptune,* and *Cumberland* in company. At noon of the 28th September, 1809, civil time, we were in lat. 21° N., and long. 115° E. nearly, and in 64 fathoms water, running for the Lema Channel. After noon, the barometer, already low, fell fast, and the gale came on rapidly, beginning at the N. N. W., and gradually veering round towards midnight to N. N. E., at which time it attained its greatest fury, and blew a hurricane. At 4 A. M. it veered round to East, and very gradually to E. S. E., and last of all to S. E., at which point it moderated, after continuing with great violence for nearly 48 hours. I do not remember whether it was on the full or change of the moon. The sky was dark and lowering, and the drift of the sea so thick and heavy, that we could see nothing, and lay like a log absolutely helpless. The force of the wind may be inferred from the fact, that the bights of our main top-mast staysail were blown away from between the turns of the gaskets, and small double pieces of canvas out of the clues of the topsails, as they hung below the yards. The *True Briton* was never more heard of, and the other ships were all more or less roughly handled."

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* The *Neptune's* Barometer is not marked in the extract sent me, but we learn from Horsburgh, vol. ii. p. 267, that it fell in this storm from 29.85 to 28.30.

I now give the tabular view as before, and then the grounds upon which I have assigned the track laid down.

Tabular View of the Tyfoon of 28*th to* 30*th Sept*. 1809 *in the China Seas.*

Date.	Ships' Names.	Winds and Weather.	Lat. N.	Lon. E.	Bar.	Ther.	Remarks.
			° '	° '			
Noon 27th Sept. 1809.	H. C. S. Cumberland,	Light airs N. to West till midnight, ...	19 47	114 43	..	..	Much lightning to the Westward.
	Scaleby Castle, ..	The same, ...	19 48	114 43	..	..	The fleet in company.
	Neptune, ...	The same, ...	19 51	114 43	..	..	
Noon 28th Sept. 1809.	H. C. S. Cumberland,	N. N. W. at 9 P. M. hard gale N. N. W... ..	20 51	114 48	29 13	81	Gale veered at 9 P. M. to N. N. E. At midnight boats blown away piecemeal.
	Scaleby Castle, ..	N. N. W. P. M. N. N. W.	20 55	114 48	..	..	Bar. fell in 12 hours from 29.85 to 29.50, but afterwards very fast; by 9 P. M. tremendous hurricane, midnight N. E. by N.
	Neptune, ...	The same, ...	20 53	114 48	..	..	1 P. M. N. N. W. 5 wind North, ½ past 8 lost the mizen mast, N.E. at midnight—N. B. the fleet had now separated.
Noon 29th Sept. 1809.	H. C. S. Cumberland,	10 A. M. S. E. hurricane,	20 33	114 54	28 65	81	P. M. E. S. E. at 11 East, lost small bower.
	Scaleby Castle, ..	1 A.M. East, 5 E. S E. Noon E. S. E. hurricane 5 P.M. E. S. E., 9 S. E.	20 26	114 37	..	..	Bar. 28.30 at midnight, began to moderate towards Noon.
	Neptune, ...	4 A. M. East, 6 E. S. E. Noon S. E. by E. and S E. midnight.	.. ..	.. ..	..	..	Lost fore-topmast.
Noon 30th Sept. 1809.	H. C. S. Cumberland,	9 A. M. S. E. by E. moderating.	20 58	112 15	29 20	79	
	Scaleby Castle, ..	S. E. at Noon, and from daylight.	20 26	111 34	..	..	Barometer began to rise after day-light.
	Neptune, ...	A. M. and P. M. hard gales, ...	No Obs.	No Obs.	..	..	Ship on her beam ends, but moderating a little at midnight.
Noon. 1st Oct. 1809.	H. C. S. Cumberland,	No log, ...	.. ..	.. ..	..	..	
	Scaleby Castle, ..	No log, ...	.. ..	.. ..	..	..	
	Neptune, ...	8. A.M. S. E.	20 48	.. ..	..	..	10 A. M. Wore, *Scaleby* to the North.

For the first part of this storm we may speak of the fleet as one ship, being closely in company. I shall latterly, of course, separate my remarks, as the ships themselves were separated. It appears from the logs that from noon to midnight on the 27th, they made a little Northing with the variable winds, and on the 28th, from midnight to 4 P. M. when they hove to, they were going from two to six knots to the north, making a difference of latitude of 64 miles in the 24 hours, but no Easting. This northing was an important circumstance, for the storm had fairly commenced at daylight on the 28th, when the remark in the *Scaleby Castle's* log is, "A. M. At this time the weather had rather a threatening appearance, but the Marine Barometer had not fallen a great deal." The wind was at N. N. W. and N. by W. at 9 A. M. with the *Cumberland*, and it is marked at N. N. W. at noon, with all three ships. We may thus take the centre of the hurricane to be bearing E. N. E. from the fleet at this time; we have no means of ascertaining at what distance.

From about 4 P. M. on the 28th, the ships were lying to on the larboard tack in a severe gale rising to a hurricane, with the wind veering from this time, when it was N. N. W. to N. by E. and N. N. E., and N. E. by N. At midnight N. E., then East and to E. S. E. by 5 P. M. with some, and finally S. E., by noon on the 30th with them all. Some variations as to the times of veering occur of course, for to say nothing, in such weather of log board and of copying inaccuracies, the ships were now separated. We may however say, that in the 44 hours between 4 P. M. 28th and noon of 30th, the wind veered from N. N. W. to S. E. or 14 points; or a point in 3 hours. It was then clearly a hurricane passing close to the southward of the fleet, which was drifting back to the Southward, South-westward, Westward and North-westward, or round the curve of its North-western and North-eastern quadrants, and from its extreme fury, their position with respect to its centre, as above stated, and the fall of the Barometer to 28.30, where it remained for 24 hours according to the *Scaleby's* log, we may safely suppose that they were at no great distance from the centre of it, and the unfortunate *True Briton* being probably a more leewardly vessel, was carried farther to the South by the Northerly part of the gale,* and therefore near to or *into* the centre.

I have therefore marked for this storm a track from N. 60° E. towards S. 60° W., or about N. E. by E. to S. W. by W. and between the Pratas Shoal, and the edge of soundings, which will allow the ships to have been about 50 miles from the centre of it. The curious circumstance of the great Westerly drift again occurs in this as in the *London* and *Warley's* storms, shewing clearly that the storm wave, or storm current was carrying the vessels with it with great rapidity. The *Scaleby's* log it will be noted, says 111 miles between noon of the 28th, and noon of the 30th, or 48 hours. They undoubtedly made every allowance before coming to this conclusion, and their chronometers were corrected, if any error existed in them, by their arrival in a few days in China. The impression there evidently was, that the *True Briton* might have been lost by this current carrying her on to the Coast of Hainan, or amongst the shoals in the strait between Hainan, and the Coast of China;† for we learn from Horsburgh, p. 328, vol. ii. that in April 1810, Captain D. Ross, then surveying the China seas, was sent down to the Coast of Hainan in search of her. I shall notice more at length this remarkable current at the conclusion of these memoirs.

TRACK No. VI.

Tyfoon of 20th to 30th September, 1810.

Documents from the India House.

On the 28th to 30th September, 1810.—The *H. C. S. Arniston, Wexford, Alfred, Winchelsea, Elphinstone, Woodford,* and *Cuffnells,* bound to China, experienced a severe tyfoon in the China seas. The following are the abridgements of their logs:—

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* Every seaman is aware how some vessels, in a fleet both Merchantmen and Men of War, though holding a good wind in average weather, will become much more leewardly than others, when the force of a storm depresses them beyond a certain bearing.

† The ships in this storm were all drifted close to these Shoals, as will be noted by their latitude and longitude on the 30th.

Log of H. C. S. ARNISTON, *Captain S. Landon, reduced to civil time.*

At noon, 27th September, 1810.—Latitude 17° 43′ N., long. 115° 9′ E. P. M. moderate breeze E. N. E., and hazy weather, at 3 P. M., wind N. E. At midnight strong breeze from N. N. E. with a heavy swell from the N. E.

28th September.—Increasing from the same quarter, ship by noon under storm staysails, latitude by account 17° 6′ N., longitude 115° 4′ E. P. M. very threatening sky and blowing very heavy; high sea rising, wind N. by W. to North till midnight.

29th September.—After midnight "wind veering round to the South." At 3 P. M. wind about N.N.W. by 4 about West, by 5 about S. S. W., from daylight to noon blowing most violently from South and S. S. W., with a prodigious high sea running, 6 A. M. wind marked S. by W. Noon no observation. 1 P. M. wind South, gale moderating and sea falling. At 10 P. M. wind S. E. On the following morning at daylight bore up and made all sail.

Log of the H. C. S. WEXFORD, *Captain W. S. Clarke, reduced to civil time.*

26th September, 1810.—Latitude 17° 13′ N., longitude not given, but nearly that of the fleet with which she was in company. 1 P. M. wind N. E. by N. Heavy clouds, squalls and rain. 2 P. M. thickening sky to the East, squally and unsettled from this to sun-set, *when it began to disperse.* 8 P. M. wind N. E. Lightning and thunder to the Northward, *the night fine* and moderate.

27th September.—A. M. Easterly wind with hazy weather E. by N., at 7 E. N. E., fleet standing to the northward against a heavy head swell which occasioned them to pitch deep at times. Noon latitude 17° 41′ N., longitude (of the fleet) about 115° 11′ E.* P. M. wind E. N. E. hazy weather, 5 N. E., 7 N. E. by N., blowing fresh with small rain, preparing for a gale; heavy head sea.

28th September.—2 A. M. wind N. by E. Squally and increasing. Noon N by W. latitude 2 alt. 17° 6′ N., longitude 115° 58′ E. Fleet much scattered. P. M. wind North. 3 P. M. hove to under storm staysails, 5 wind N. N. W. Hard gale with very hard squalls till midnight, when about N. by W.

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* The mean of 4 ships not greatly differing. The Chronometer of the *Cuffnells* is omitted in the average as being evidently 30 miles too far East; she was closely in company.

29th September.—2 A. M. N. W. by N., 4 N. W., by W., 5 S. W. and at noon S. S. W., heavy seas breaking over the ship from daylight till noon, " when it blew a perfect hurricane." P. M. wind South, hove to under trysail. Wind about South till midnight, when moderating.

30th September.—Bore up and out all reefs at daylight. Noon, latitude 18° 24′ N.

Abridged Log of the H. C. S. ALFRED, *Captain Welstead, reduced to civil time.*

26th September, 1810.—Noon, latitude and longitude that of the fleet. Variable winds from N. E. to N. W. till midnight.

27th September.—To noon letting out reefs. Lat. 17° 45′, long. of the fleet 115° 12′. Bar. 29.95. Ther. 81°. P. M. N. E. by E. hazy; high sea from N. E.

28th September.—1 A. M. wind N. N. E. At 11 A. M. North, preparing for bad weather. Noon latitude 17° 27′, longitude of the fleet 116° 0′ E. Bar. 29.65. Ther. 82°. P. M. Wind N. N. E., 3 P. M. hove to, increasing storm till midnight. Wind veering to the South.

29th September.—A. M. Severe tyfoon. 5 A. M. wind marked S. W. and at 8 S. S. E. Saw a ship (supposed the *Elphinstone*) bearing away before the wind. Noon blowing furiously from South. Lat. account 17° 31′ N. Bar. 29.575. P. M. S. S. E., strong gale till midnight, moderating at 7 P. M.

30th September.—At daylight made sail with wind at S. W., noon latitude 18° 30′, longitude 116° 30′. Barometer 29.875.

Abridged Log of the H. C. S. WINCHELSEA, *Captain The Hon'ble Hugh Lindsay, reduced to civil time.*

26th September, 1810.—Latitude 17° 33′ N, longitude 115° 16′ E. variable winds N. Easterly till midnight.

27th September.—6 A. M. E. N. E. light winds, steering to the Northward, latitude 17° 47', N. longitude 115° 14' E. Barometer 29.92. Thermometer 81°. P. M. E. N. E. fine weather, but increasing breeze N. E., at 5 P. M. N. E. by N., at 9 high sea from the N. E.

28th September.—2 A. M. N. N. E. increasing; making all preparations for bad weather. Noon latitude 17° 30' N., longitude 116°. Barometer at 8 A. M. 29.80, noon 29.70. Thermometer 80°, 1 P. M. hove to, wind about N. N. W. but not marked, blowing excessive hard. Barometer 11 P. M. 29.20.

29th September.—4 A. M. West, 6 A. M. S. W. bore up, and ran 36½ miles to the N. N. W. and N. by W., hove to again at 10. Noon blowing excessively hard from South; latitude account 17° 36' N. N., longitude by account and D. R. 116° 11' E.* Barometer 10 A. M. 29.23 ? Noon 29.36, 5 P. M. wind S. by E., gale moderating, and sea much fallen, at 8 S. S. E. 6 P. M. Barometer 29.65. Bore up at 7 P. M. and ran 6 and 7 knots till midnight, steering N. by W.

30th September.—By midnight fair, at noon fine, and had run from 7 P. M. on the 29th to noon 30th 119 miles N. by W. and N. by W. ½ W. Latitude observed 19° 54' N. longitude chronometer 116° 00' E. Barometer 6 A. M. 29.80, noon 29.90.

Abridged Log H. C. S. ELPHINSTONE, *Captain M. Craig, reduced to civil time.*

27th September, 1810.—Noon, latitude 17° 41'.N. longitude 115° 6', P. M. fine and variable from E. N. E. to N. N. E. till midnight.

28th September.—5 A. M. N. by E. preparing for bad weather. Noon latitude 17° 16'N. longitude chronometer 115° 53' E. P. M. strong gales N. by E. with hard squalls, 3 P. M. wind N. W. by N. At 5 North, and at 10, N. by W.

29th September.—1 A. M. wind N.N.W. at 3 W.N.W. at 5 S.S.W. at 6 South, at 9 S. by W. at 6 A. M. bore up under fore staysail to look for the Commodore, and ran North five miles. At 8 saw two ships to the S. W. lying to, hove to again. At ½ past 9, one bore up across us, gale much increased since daylight. At 10, bore up again, steering North 10½ miles. At 11, fore staysail blew to pieces, sea prodigiously high, rapid, and violent, hove to again, several seas breaking over the ship; set mizen storm stay-sail which blew to pieces, much water between-decks. Noon, water increasing fast, set the weather clue of the fore-sail to wear, but it blew to pieces; latitude by log worked back from 30th 18° 4′, longitude 115° 22′ N. P. M. "an inconceivable increase in the fury of the storm and violence of the waves, ship almost water-logged, apparently settling fast. At half-past one, cut away the mizen-mast, but the ship not wearing, yard arms in the water, and being deadly water logged, cut away the main-mast at ¼ before 2, when she paid off, though she heeled gunwales in; hove the starboard upper guns overboard. All hands at the pumps, steering N. E. At 10 P. M. wind S. by E.

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* The Log worked back from the 30th gives latitude 17° 46', longitude 115° 35', and as she was going free most part of the time, it is far more likely to be correct than a dead reckoning brought forward through the storm

30th September.—At 5 A. M. steered North for an hour, but hauled up again to N. E., moderating gradually. Noon latitude 19° 05′ N., longitude chronometer 116° 26′ E.

No farther logs are given, but the ship had afterwards fine weather like the rest of the fleet.*

Abridged Log of the Hon'ble Company's Ship WOODFORD, *Captain John Martin, reduced to civil time.*

26th September, 1810.—Latitude 17° 30′ N., winds light and variable from N. b E. and N. N. E., at midnight very black to the N. N. E.

27th September.—A great head sea N. E., out all reefs, noon latitude 17° 40′ N. Barometer 29.80. Thermometer 82°. P. M. wind E. by N. and N. E., at 8 P. M. fresh breeze increasing.

28th September.—Increasing from midnight, at noon hard gale, three ships only to the N. b E. in sight. No observation. Barometer 29.20. Thermometer 82°. P. M. wind North and N. b W. very hard gale to midnight. At 2 A. M. wind veered to W., at 4 to S. W., set mizen topsail and foresail, and bore up, steering North, but at 6 it came on to blow with such dreadful violence from S. S. W. that they were taken in, and the ship scudded* under storm fore staysail. At 11 hove to under the trysail. Excessive hurricane of wind, with very thick rain and heavy sea. This ship ran from a little before 5 to 11 A. M. 27½ miles to about the N. W. b W. Noon Barometer 29.20. P. M. wind South, blowing a hurricane, at 9 P. M. South, and moderating at midnight.

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* The Barometer is not marked in the extract sent, but we learn from Horsburgh, Vol. ii. p. 267, that it fell in this storm from 29·85 to 28·30.

29th September.—At 5 A. M. wind South, bore up and ran 29½ miles to the North, and at noon, saw four ships of the fleet from the mast-head bearing S. E. At noon latitude 18° 37′ N. longitude chron. 115° 51′ E. Barometer 29.70. Thermometer 80°.

Abridged Log of the H. C. S. CUFFNELLS, *Captain Welbank, reduced to civil time.*

27th September, 1810.—Latitude 17° 46′ long. of the fleet 115° 12′† P. M. the winds and the weather as with other ships E.N.E. and N.E.

28th September.—Making all snug, noon increasing gale, latitude account 17° 12′ N., longitude 116° 0′. E. P. M. wind North, and N.N.W. towards midnight and *moderating.*

29th September.—The sea log says " middle part," (which is here from 8 P. M. 28th to 4 A. M., 29th) the wind *moderated,* and drew gradually round to the N. W., S. W. and S. S. W., when it increased to a hurricane with a high sea from the West, thick spoon-drift; wind marked S. W. at 3 A. M., and S. S. W. at 11. 1 P. M. S. S. W. and at 9 also S. S. W.; at 7 bore up, wind South, and ran 29 miles to the N. b W.; three ships in sight, *Wexford, Alfred,* and *Arniston.* Noon latitude 18° 30′ N., longitude 116° 42′ (properly 116° 12′.)

This fleet generally was so close together that it does not seem necessary to give any tabular view of the winds and weather at noon. I shall therefore only state here the views which induce me to lay down the track in the direction which I consider that of the storm.

We find that before noon on the 28th, these fine ships were sending down top-gallant yards and masts, so that we may fairly say the storm had then commenced. With two ships at 1 P. M. the wind is marked at North, with three at N. by E. and with one at N.N.E., but as they were dispersed over perhaps eight miles of distance this might occur. We shall not be far wrong if we take the wind to have been N. b E. for this time for the whole fleet, which it will be observed also, was upon the larboard tack standing or rather drifting to the Eastward and Southward. The centre of the storm at this time would then bear about E. b S. of them.

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* This is written *lay to* in the extract, but is evidently an error.

† See note at p. 633.

By 12 on the following day the wind which had veered rapidly to the N. W., West, and S. W., shewing that the centre had passed close to the Northward of them, was

With the	*Cuffnells*, ...	S. S. W.
„	*Woodford*, ...	South,
„	*Elphinstone*, (about) ..	South,
„	*Winchelsea*, ...	South,
„	*Alfred*, ...	S. S. E.
„	*Wexford*, ...	South,
„	*Arniston*, ...	South,

but as they were now much dispersed, we may take South to have been the limit of the change within the 24 hours, or 17 points, *i. e.* from N. b E. to S.

The projection of this, with due allowance for the drift, which was round the S. Western and S. Eastern quadrants of the storm circle, and without forgetting that with the ships which were farthest to the Northward the wind was at 8 P. M. S. S. E., will give about a track from the E. b N. to W. b S. for the storm, and I have so marked it.

The distressed state of the *Elphinstone*, which was at one time as near foundering as possible, and the extreme violence of the wind recorded in her log, was evidently owing to her having, by bearing up, ran and drifted more to the North-west than she appears to have done by the mere log. The *Winchelsea* also bore up, as did the *Woodford*, but neither of them had the wind so violent as the *Elphinstone*. This is accounted for by working back their logs, which though always, (and particularly with the *Elphinstone* in this case), an imperfect record, is still the only authentic one. From this it appears that both the *Winchelsea* and *Elphinstone* had an observation, and sights for chronometer on the 30th, and the logs worked back to noon of the 29th place the *Elphinstone,* then, at least 22 miles to the N. W. of the *Winchelsea ;* which was of course 22 miles nearer to the centre of the storm, and it is at this time that her log speaks of the "most inconceivable increase in the fury of the storm." If then, judging from some of my former memoirs, in which by means of two or more shore or ship observations we can in some degree judge of the violence of the wind at given distances from the centre, we can make any estimate of the actual measured distance of the *Winchelsea* from the centre, and call it at most 40 miles? the 22 miles farther to the N. W. of the *Elphinstone's* probable position would then place her exceedingly close to it. We do not know in what ratio to the distances from the centre the violence of the wind augments, but it is evident, here, that the short distance was of such import, that it nearly involved the loss of the ship! I need not say how important this lesson is to the seaman, teaching him not to allow himself to be tempted by a fair wind into bearing up too soon, when it is not of actual necessity that he should do so.

TRACK No. VII.

Tyfoon of H. M. S. THEBAN AND FLEET, *8th and 9th Sept.,* 1812.

Documents from the India House.

8th and 9th September.—His Majesty's Ship *Theban,* with the H.C. Ships *Marquis of Huntly, Cirencester, Elphinstone, Bombay* and *Alnwick Castle,* bound to China, experienced a severe tyfoon in the China seas, in which the *Theban* and *Cirencester* were left with only their foremasts standing. The other ships escaped without damage.*

The H. C. S. *Glatton* was at the same time about three degrees to the Southward of them, and had only a heavy or strong gale. Her log, from which some instructive inferences may be drawn, is subsequently given.

The following are the abridged logs of the fleet:—

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* Horsburgh says of this storm in a note Vol. II. p. 267, that Captain Craig of the *Elphinstone,* warned by his Barometer, prepared for a tyfoon, and sustained no injury. This was also the case with others of the ships, as we shall see. The *Cirencester* was fully prepared, but lost her masts from the chain plates giving way.

Abridged Log of H. M. S. Theban.

7th Sept.—Noon latitude 16° 6′ N. long. of the fleet 114° 16′ E.

8th September.—4 A. M. wind W. by N.; under storm-sail. At 1 P. M. wind West, strong gales with heavy rain. Split the fore-sail. At 8, heavy gales, W. S. W., at 9, lost the main-mast, at 10h. 15m. the mizen-mast, at 11h. 15m. the fore-top-mast. Lat. at noon 16° 23′ N. long. 116° 51′. E. Midnight the wind S. W. blowing very hard.

9th September.—1 A. M. wind marked W. by S. heavy gales. Noon strong breezes, S. S. W., *Elphinstone* in sight; by midnight fair weather.

The logs of the fleet will be better and more briefly exhibited in the following table, than by abridgements, as they were all near each other:—

Tabular View of the Logs of the Fleet under convoy of H. M. S. Theban, *in the Tyfoon of the 8th and 9th September*, 1812, *reduced to civil time.*

Date.	Ship's Name.	Winds and Weather.	Lat. N.	Long. E.	Bar.	Ther.	Remarks.
7th September, 1812.	Elphinstone, ..	1 P.M. N.E. At 4 N. midnight N.W.bN. increasing to hard gale. ..	Noon. ° ′ 16 14	° ′ 114 16 E.	..	..	Making every preparation for bad weather. Long. that of the fleet.
	Cirencester, ..	1 P.M. N.N.E. 3 North, 7 N.N.W. increasing from the N.W. with thick weather.	16 7	114 16	..	..	As above.
	Marquis of Huntly,	1 P.M. N.bE. increasing as with the others, ..	16 11	114 16	..	..	As above.
	AlnwickCastle,	1 P.M. N.E.bN. and about N.N.W. at 9 P.M. increasing.	16 7	114 16	..	..	As above.
	Wexford, ..	P.M. N.E., 4 P.M. North, 9 P.M. about N.bW. and increasing.	16 3	114 16	29 50	84	As above, Bar. 6 P. M. 29·45, midnight 29·40.
	Bombay, ..	1 P.M. N.N.E. 4 North, 7 N.bW. increasing; at 9 about N.N.W... ..	16 7	114 16	..	..	Preparing for bad weather.

Date.	Ship's Name.	Winds and Weather.	Lat. N.	Long. E.	Bar.	Ther.	Remarks.
			Noon. ° '	Noon. ° '			
8th Sept. 1812.	Elphinstone, ...	3 A.M. W.bS. 5 W.bN., 11 W.N.W. heavy gales; 1 P.M. W.bN., 11 P.M. W.bS., midnight W.S W. blowing excessively hard in gusts, ...	16 20	114 54	..	..	Hove to under storm staysails, and latterly trysail; throughout large sea from the West, constant rain, and dark gloomy weather.
	Cirencester, ...	3 A.M. N.W., 6 W N.W. 1 P.M. W.bN., 5 West...	16 7	.. ..	..	..	From 3 A.M. under storm staysails, and latterly bare poles; 10 P.M. lost main mast, by the chain plates giving way, also mizen mast and fore top mast.
	Marquis of Huntly, ..	3 A.M. W.S.W. no other wind marked. P.M. W.bS., midnight about W.S.W.	acct. 16 11	115 19	..	..	Under bare poles.
	Alnwick Castle, ..	4 A.M. West and W.bN. Excessive hard gale from 8 A.M. 1 P.M. West 6 S.W.bW.	acct. 16 10	114 58	29·32	81	By noon hove to under main and mizen stay-sails, violent squalls and gusts.
	Wexford, ...	4 A.M. W.bN. & N.W. 11, W.N.W., 1 P.M. West, 4 W.bS. heavy gales...	.. ..	.. ..	29·20	80	From 8 P.M. hove to, Bar. 8 A.M. 29·30 noon 29 20 6 P.M. 29 15 midnight 29·15.
	Bombay, ...	1. A.M. about N.W.bN., 3 A.M. about N.W., 5 about W.N W., 9 West. 1 P.M. W.bS. and W.S.W., strong gale as above,	16 24	114 04	..	..	From 9 A.M. hove to as above. See Capt. Hamilton's note on the storm in page 643.

Date.	Ship's Name.	Winds and Weather.	Lat. N.	Long. E.	Bar.	Ther.	Remarks.
9th Sept. 1812.	Elphinstone, ...	1 A.M. S.W.bW. hard gale and heavy gusts till 8 A.M.—P.M. S.W.bW. moderate.	Noon. ° ′ 17 1	Noon. ° ′ 116 10	..	..	To 8 A.M. heavy gale, at 8 A.M. moderating, bore up.—P.M. saw the Theban to the W.N.W.
	Cirencester, ...	7 A.M. W.S.W. strong gales, P.M moderating, 5 P M. S.W., 10 S.W.bS.	16 30	116 10	..	..	Clearing the wrecks and rigging jury masts. Lying to.
	Marquis of Huntly, ..	A.M. moderating, P.M. S.W.bW.	acct. 16 31	114 58*	..	..	At 8 A.M. bore up.
	Alnwick Castle, ..	7 A.M. W.S.W. bore up, 1 P.M. W.S.W. ..	16 42	115 47	29 40	81	Barometer when lowest 20·19, but time of this not given; moderating at daylight, and bore up at 7½ A.M.
	Wexford, ...	7 A.M. S.W, 1 P.M. S.W by W.	16 36	115 44	29·35	81	Ther. 84°, moderating at daylight as with the others.† Bar. 8 A.M. 29·20, noon 29·35.
	Bombay, ...	Wind not marked, ..	16 38	.. ..	..	..	Bore up at ½ past 10 A.M.

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* 113° 58′ in the MSS. evidently an error, as she was in sight of the *Bombay* and *Alnwick Castle*, P.M.

† Perhaps?

The following remarks are from the log of the *Bombay,* Captain Montgomerie Hamilton, they give a very good epitome of the storm :—

"*9th September,* 1812, *Nautical time.*—Throughout hard gales at S. and W. with squalls and rain; towards noon more moderate. From 8 A. M. on the 8th of this month to about 5 on this day, experienced very blowing weather. From having the fresh S. W. monsoon on the 6th, the wind drew round to the Eastward with squalls, at times, drawing round to the Northward on the 8th, when it gradually freshened up with a regular fall of the Barometer, the wind coming round to the West, and blowing most severely from the W. N. W. and W. S. W. breaking up from the W. S. W. to S. W. blowing extremely hard, with furious gusts and hard rain throughout. The peculiar indications of this weather coming on were a gradual fall of the Barometer, which fell one-tenth below 29.00* the weather feeling hot and close, hotter than at an equal height of the Thermometer at this time, which was 81 degrees. When the wind was to the Eastward, it was light with a clear horizon and dusky flying clouds. The wind drawing to the Northward, the horse flies† made their appearance. Had no extraordinary swell previous to its coming on."

We have now to abridge the log of H. C. Ship *Glatton,* which as I have stated, was about three degrees to the Southward of the fleet, but nearly on the same meridian.

Abridged Log of the H. C. S. GLATTON, *Captain Jas. Halliburton, reduced to civil time.*

6th September.—The *Glatton* was in latitude 10° 28′ N. longitude 111° 12′ E.

7th September.—A. M. log for this day is not given, but working back from that of the 8th she was at noon in latitude 12° 00′ N., longitude 112° 15′ E. P. M. winds from N. N. W. variable and squally till midnight.

8th September.—From midnight strong squalls, bent storm stay-sails. 4 A. M. wind S. W., 7, W. by S. Noon blowing fresh, lat. 13° 18′ N., long. 114° 32′. E. Bar. 29.48. Ther. 81°. P. M. strong gales West, steering North, 5, 6, and 7 knots, heavy confused sea. 11 P. M. hard squalls and sharp lightning.

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* So in MSS., but probably an error, as 29.15 is the lowest registered depression in the log.

† Horsburgh.

9th September.—2 P. M. W. S. W. going 5 and 6 knots to the N. N. W. and N. by W. till noon, when in latitude 15° 30′ N., long. 114° 46′ E. Bar. 29.30. Ther. 84½. P. M. wind W. S. W. moderate, but heavy confused sea.

10th September.—Till noon the heavy confused sea continues, latitude 17° 51′ N., longitude 113° 52′ E. Barometer 29.50. Ther. 84.

We have now to consider the probable track of this storm. It is clear from its mode of veering, that it was one passing to the Northward of the fleet, and we may perhaps suppose its centre to have been at one time, from the great depression of the Barometer, not more than 40 or 50 miles distant. Its track is next to be considered.

We have not the *Theban's* log for the 7th, but as towards evening, say 6 P. M. of that day, the Indiamen had all sent down top-gallant yards, and struck the masts, we may fairly take the gale to have began by this time from N. N. W., and we find very clearly from Captain Hamilton's remark in the *Bombay's* log, which I have just quoted, that it was "breaking up" between W. S. W. and S. W., that is about S. W. by W. The drift of the fleet was about E. S. E. or E. by S. Projecting this, it gives about a W. half N. course for the centre of the storm, which I have taken. It could I think be hardly more than W. by N. and certainly was not due West.

The *Glatton* was too far to the South, and too nearly on the same meridian, to afford us any assistance in estimating the track of the storm, though it is clear it was of no great extent, since it barely reached her. Her crossing the "confused sea," which the centre of the tyfoon left behind it is curious; and an exact confirmation of what occurred to the *London Thetis,* in the *Golconda's* storm of September 1840, as will be subsequently noticed.*

The barometrical observations made on the *Wexford,* for which I am indebted to Mr. Packman's notes, are of much interest. It would seem from them, (and they are so fully corroborated by those of the other ships which have noted the state of theirs in their logs, that we may accord them full confidence,) that the total depression was as follows :—

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* See Fourth Memoir on the Law of Storms, Jour. As. Soc. vol. x. p. 905.

	Ther.	Bar.	
6th Sept.—Noon,	82	29.60	Wind westerly squalls & rain.
7th Sept.—Noon,	84	29.50	Easterly, squally, unsettled, latterly N. E.
6 P. M.	83	29.45	N. E. & Northerly.
Midnight,	82	29.40	N. Westerly heavy gusts.
8th Sept.—8 A. M.	82	29.30	Gale N. Westward.
Noon,	80	29.20	
6 P. M.	80	29.15	
Midnight,	79	29.15	
9th Sept.—8 A. M.	79	29.20	
Noon,	80	29.35	
8 P. M.	80	29.60	

From this it appears, that from noon on the 6th, to 6 P. M. on the 7th, when we have taken the gale to begin, the depression was 0.05 only in 30 hours, though it had fallen 0.10 in the 24 hours between noon of the 6th and 7th. We then find it from 6 P. M. of the 7th to 6 P. M. of the 8th, or in 24 hours, falling 0.30. It is useful to notice these variations, because they afford a valuable lesson to those who will take the trouble to reflect on them. The *Glatton's* Barometer also gave her, by a fall of 0.18, full notice of the passage of the storm. I shall refer to these subjects more at length in a separate memoir.

TRACK No. VIII.—*Tyfoon of 28th and 29th October* 1819.

Document from the East India House.

By Capt. Probyn, H. C. S. MINERVA.

The H. C. Ship *Warren Hastings* on October 25th 1819, was in latitude 18° 56′ N., longitude 119° 6′ E., when a fresh gale commenced from N. E.

26th October.—Noon latitude 19° 42′ N., longitude 118° 21′ E., increasing gale from N. and N. E.

27th October.—Lat. 19° 58′ N., long. 118° 2′ E., strong gale N. E.

28th October.—Lat. 19° 52′ long. 118° 2′ E., strong gale N. N. E. to N. N. W. with drizzling rain and a high sea.

29th October.—Lat. 19° 50′ N. long. 118° 51′ E., severe gale N. W. with rain.

30th October.—Lat. 20° 9′ N., long. 118° 59′ E., gale increasing in violent gusts to a tyfoon, and shifting round from N N. W. to South Westward, and S. E., with thick weather and a high confused sea.

31st October.—Lat. 20° 21′ N. long. 118° 29′ E., gale moderating from N. E. The thick weather prevented any observation for five days. The wind shifted during the height of the tyfoon, the duration of which did not exceed twelve hours.

This single document, is the only one I have relative to this storm, still, with the assistance of the ship's positions, as the centre evidently passed over, or close to her, it enables us to ascertain its track on that day at least, the 30th, with tolerable certainty, to have been from the E. by S. to the W. by N. coming in, as it undoubtedly did, from the Pacific Ocean. How much of the N. E. gale of the preceding days was part of the tyfoon, and how much the setting in of the N. E. monsoon, we cannot in the absence of any Barometrical observations pronounce. With the N. E. monsoon, the Barometer would have probably risen, while with the storm it would have sunk. It does not seem to have been of excessive violence.

I have marked its track, as shewn by the shift, to the E. by N., and crossing the ship's position at noon on the 30th.

TRACK No. IX.—Lord Castlereagh's *Tyfoon.*

From the Calcutta Journal of February, 1821.

The following brief though distinct notice of a small tyfoon, (for from its violence and change it certainly was entitled to be called one,) is remarkable and useful, as shewing in how low a latitude these may be encountered in the N. E. monsoon. I have not met with any farther notice of it, and mark its track as an East and West one, from the change stated in the account. The longitude of the ship is not given, but it is not of consequence, for in that latitude owing to the shoals and the coast of Cochin China, ships are mostly about the meridian of 109° E. We shall subsequently notice other instances of the N. E. monsoon tyfoons about this latitude.

" The *Lord Castlereagh* left Whampoa on the 24th November, 1820, and on the 29th, in about latitude 12° N. about 9 A. M., she encountered a heavy gale of wind, which soon increased to a severe tyfoon from the North. She was kept before the wind till about half-past 9, when she broached to. The mizen-mast was then cut away, and she scudded again. At noon she again broached to, when the crew could do nothing. The wind abated a little about 1 P. M., but in half an hour veered to the Southward, and soon increased to all its former violence; so that the vessel became unmanageable and a mere wreck, with every sail blown from the gaskets, the crew could not keep the deck. At 5, the gale began to abate, and between 11 and 12, the weather became moderate.—*Calcutta Journal, February,* 1821.

TRACK No. X.

Tyfoon of the 19th October, 1821.

Documents from the East India House.

18th and 19th October, 1821.—The H. C. Ships *General Kydd* and *General Harris,* bound to China, and in company with each other, experienced a severe tyfoon in about latitude 18° N., long. 112° 30′ E., or upon the meridian, and a little to the Northward of the Paracels. The following are their logs:—

Abridged Log of the H. C. S. **General Kydd,** *Captain Alexander Nairne, reduced to civil time.*

15th October.—Noon latitude 19° 28′ N. Hainan Head, bearing N. 11 W. to S. 76 W.

*17th** *October.*—By noon latitude 17° 59′ N. A smart breeze from N. E. P. M. wind N. E. by N. standing eight knots to the E. S. E., increasing to a gale with hard gusts before midnight. Wind about N. N. E.

18th Oct.—A. M. increasing to noon, (wind about N. N. E.) making, all snug for bad weather. No observation. P. M. increasing from NbE.

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* Log of the 16th is not given.

ship under storm stay-sails, all of which with several of the other sails were blown away from the yards before midnight. Strong tyfoon with violent gusts, a tremendous sea and incessant rain, sea making a clear breach over the ship. Under bare poles from half-past 7 P. M. and wind veering to about N. E. by midnight.

19th October.—A. M. heavy tyfoon, sea breaking over the gunwale, and boats washing away. At noon it still continued in severe gusts and tremendous sea. No observation. Wind about E. S. E. P. M. S. E. by E. At 5, gusts not so frequent and hard. Wind about S. E. by S.

20th October.—Moderating fast at 4 A. M. By 9 made sail, wind S. E. by E. Noon latitude 18° 21′ N. longitude 112° 40′ E. Barometer in the height of the tyfoon at 28.65, but only this single notice of it.

Abridged Log of the H. C. S. GENERAL HARRIS, *Captain Welstead, reduced to civil time.*

15th October.—Latitude 19° 30′ N. High land of Hainan N. N. W. Taya Islands N. by E. Log of the 16th not given.

17th October.—At noon in company with the *General Kydd,* latitude observed 18° N., longitude 112° 30′ E. Bar. 30.00. Ther. 85°. Standing S. E. by S. with a 5 knot breeze from N. E., P. M. to midnight squally. Barometer at 9 P. M. 29.90.

18th October.—Increasing wind, about N. N. E. and N. E. by N. Noon hard gale and making all snug. No observation. Bar. 9, A. M. 29.70. P. M. Wind marked North, and at 7 P. M. N. E., hard gale with violent squalls throughout, losing sails, boats, &c.

19th October.—The same weather 10 A. M. Wind East. Cut away the main-yard which was adrift. Noon no observation. Bar. 28.75. Ther. 82°. At 2 A. M. wind S. E. by E. 1 P. M. shipping seas so heavily to leeward and over all, that it was necessary to heave the lee quarter deck guns and carriages overboard to make a passage for the sea ; bulkheads of cuddy washed away. 5 P. M. wore under bare poles. Wind about S. E. by E. to midnight.

20th October.—7 A. M. moderated from the same quarter or about S. E. The log remarks, " During this tempest we have experienced a most extraordinary, and providential current in favour to the N. E. Barometer in the height of the tyfoon 28.75." Ther. 82°. Lat. observed 18° 21′ N., longitude by chronometer 112° 43′ E.

If we take this storm to have begun about North, and to have ended at S. E. with the drift as made good by the observations, it will upon projection give a track about from N. 74° E. to S. 74° W. for the centre, which may probably have passed within about 40 or 50 miles of the ships. The singular anomaly of a N. E. current is very remarkable.

TRACK No. XI.

H. C. S. MACQUEEN's *Tyfoon of* 14*th and* 15*th September,* 1822.

Document from the India House.

Log reduced to civil time.

The H. C. S. *Macqueen* bound to China was on the 12th September, in latitude 17° 35′, longitude not given, and on the 14th September at noon in latitude 20° 25′ N., longitude 114° 50′ E. Squally, thick cloudy weather, and second reefs in the topsails. Wind at 11 A. M. N. W. but variable. P. M. swell from the North. 3 P. M. increasing fast from N. W. and N. W. b W. and preparing for bad weather. At 6, increasing to a tyfoon, and storm stay-sails blown away. Midnight a tyfoon about South.

15*th September.*—Moderating towards day-light, when the ship bore up with the wind at S. E., latitude at noon 20° 53′ N. In addition to the log, there is also a memorandum by Captain Bax, who was second officer on board the *Macqueen,* but he states the wind to have veered by the East to S. E. which would make the centre pass to the South of the vessel, whereas by the log it evidently passed to the Northward of her position, and I have preferred the log as a written record, the memorandum of Capt. Bax being apparently from memory. There is no wind marked in the log except N. W. at 1 P. M., but from the coming up and falling off of the ship, it is clear that the wind veered as I have stated. I have, however, in consequence of this discrepancy, marked the track as doubtful, meaning thereby, that its *position* is so, though its direction is well enough ascertained, *i. e.* both log and memorandum agree that the storm began at N. W. and ended at S. E. This, with allowance for the ship's drift, will give a track about from S. 57° E. to N. 57° W.

Capt. Bax's memorandum adds, The "above-mentioned tyfoon came on exactly as described by Horsburgh, commencing the strongest to the Northward, and veering round to East and S. E.

"For two days previous, it had been nearly calm, and numerous horse-flies covered the rigging, which Horsburgh mentions as the usual forerunners of such storms. The Barometer fell very low, and gave due notice, and the ship was prepared by its warning, but I have not a memorandum of the fall of the Barometer."

TRACK No. XII.

H. C. S. Castle Huntley's *Tyfoon of 25th to 27th Sept.* 1826.

Document from the India House.

The H. C. S. *Castle Huntley*, bound to China, experienced a severe tyfoon in September, 1826. The following is an abridgment of her log, reduced to civil time:—

24th September.—Noon, latitude 14° 17′ N., longitude 114° 10′ E. P. M. moderate and variable. Winds between N. and N. N. W. with squally weather and lightning to the Eastward towards midnight.

25th September.—A. M. squalls increasing from N. N. E., and at 10 A. M. under close reefs and reefed fore-sail, with a heavy breeze from N. E. At noon down top-gallant-yards. Latitude, indifferent observation, 14° 30′ N., longitude 114° 30′ E. Barometer 29.55. Thermometer 84°. P. M. fresh gale N. E., 5 P. M. hove to under storm stay-sails, heavy puffs N. E. at 7 P. M. Midnight N. E., violent squalls with thick rainy weather.

26th Sept.—At 1 A. M. Wind N. E., 7 A. M. N. E. At noon about E. N. E. No observation. Barometer 29.00 and falling. No appearance of the weather moderating. 1 P. M. wind E. by S. a heavy gale, and by 6 P. M. S. E. by E. About 1 P. M. Barometer began to rise, though the gale was by no means abated till midnight. 11 P. M. wind marked S. E. by E.

27th September.—5 A. M. Wind E. by S., Noon S. E. by E. again. At 6, saw the Triton Sand-bank, bearing about E. S. E., distant 10 miles; 7, made sail. At 10, by the bearings, latitude 15° 50′ N., longitude 111° 12′ N. Noon Bar. 29.53. Ther. 83°. P. M. fresh breeze from S. E. and fine. At 1 30 P. M. Discovery Shoal from N. to E. A northerly current of 47 miles for the last 24 hours.

To this log is appended the following important note: " Mr. Wise, " formerly an officer of the *Castle Huntley*, remarks, that when this " tyfoon commenced, the ship was to the East of the Macclesfield " Shoal, and drifted during it upwards of 300 miles* under bare poles, " having sighted the westernmost of the Paracels before the gale " terminated."

There can be no doubt that this was a storm passing to the South of the ship; and as the gale veered from N. E. to S. E. b E., while the drift of the ship was from noon the 25th to 10 A. M. on the 27th N. 67½° W. 210 miles, this when projected gives the centre of the storm a track of from S. 77° E. to N. 77° W., which is probably not far from the truth. The Barometer falling only to 29.00, though the tyfoon was severe, shews that the distance of 70 miles from the centre which this projection allows when it was nearest to the ship, is not excessive.

The projection will also furnish us with an approximation to the rate of travelling of the centre of this storm. The drift from noon 25th to 10 A. M. on the 27th, is as I have said 210 miles, and the centre, (the wind being N. E.) at the first epoch, bore S. E. from the ship, and at the latter S. W. by S. Assuming that at about noon on the 26th the centre bore due South, (wind being between E. N. E. at 10, and E. by S. at 1 P. M.) we have thus three lines of bearing for it, and taking the distance of it to be as I have before stated, it will be found that it must have travelled about 180 miles, or 7½ miles per hour in each of the 24 hours.

The extraordinary drift is a phenomena of the highest importance to navigation, and it is evidently analogous to those experienced on the South Coast of China, both probably occasioned by the " storm wave."

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* NOTE.—So in MSS. The measured drift is 210 miles between Noon 25th and 10 A. M. 27th. Mr. Wise's calculation seems made from an earlier hour on the 25th.

I shall not forget to notice this subject at the conclusion of the present memoir.

1827.

The object of the present memoir being not only to present details of well-ascertained storms, but also to record such imperfect knowledge as may reach us of other tempests in the China Seas, in the hope, that these notices may one day elicit others, I make no apology for inserting two notices from the valuable memoranda sent me by Mr. Packman, through the Honorable the Court of Directors.

H. C. S. SCALEBY CASTLE, *China Sea off Palawan.*

27th October 1827.—After having had for the three or four previous days, strong breezes from the N. W. to S. W., with squalls and rain, and continual thick weather, so that we could get no sights for latitude, either by day or night, it came on to blow a fresh gale in the latter part of the 26th, continuing to the 27th, and moderating on the following days with fine weather, when we obtained sights and ascertained our exact position; we were then at anchor amongst the Paraguas, off the Coast of Palawan; we had moderate Westerly winds for the next three or four days, as we stood to the Northward. Lat. about 9° 00′ N., long. 118° 00′ E.

2nd and 3rd November.—H. C. S. *Scaleby Castle.*—Variable light airs. Latitude observed 13° 56′ N., longitude per Chron. 119° 20′ E.

4th November.—Moderate breezes from the N. W. in the first and middle parts, latterly fresh from the Northward with hazy weather. Latitude observed 14° 22′ N., longitude 119° 27′ E. Blowing a fresh gale from the Northward in the first and middle parts, latterly moderating with fine weather throughout, and on the following day moderate Northerly breezes and cloudy weather. Lat. observed 14° 12′, longitude per Chron. 119° 19′.

The foregoing two storms do not furnish us with any fair data from which to deduce a track, but the first *may* have been the Southern half of a storm passing a couple of degrees to the Northward of the ship's position.

in the chart, and the second seems very probably to have been also a storm travelling towards the ship, but from which she escaped by running to the Northward so quickly.

1828.

Extract from the Log of the H. C. S. Marquis of Camden, *towards China, reduced to civil time.*

Document from Captain Wylie.

2d Oct. 1828.—At noon in latitude 19° 9′ N., longitude 116° 26′ E., cloudy weather; increasing breeze from the N. E. with squalls of rain at times. Ship standing to the North and N. N. E.. P. M., and to midnight variable light airs, and calms with heavy rain.

3d October.—At half past 12, breeze increasing to a gale at N. E., hove to under main stay-sail, hard squalls and heavy rain. No observation. The gale still continuing; 3, wore ship, wind *about* N. E. At midnight wind decreasing.

4th October.—A. M. moderating and veering to the Eastward. At noon latitude 17° 17′, longitude 115° 13′.

Again on the 7th October.—The *Marquis Camden* was at noon in latitude 19° 7′ N., longitude 115° 43′ E., blowing hard in heavy squalls and rain; increasing P. M. to a gale at N. E., with a head sea reducing her to close reefed top-sails.

8th October.—By noon the wind had veered to N. W., heavy rain and high sea continuing, wind being about N. by E. at 1 A. M., and North or N. by W. at 7. It is marked at N. W. at 11. Latitude about 18° 10′, longitude 116° 40′ at noon. P. M. a gale from N. W. ship striking topgallant-masts.

9th October.—From midnight gale continuing, but at daylight moderating a little. Noon latitude 18° 47′, longitude 117° 52′. E. P. M. gale from N. W. continuing with a heavy sea throughout.

10th October.—Wind gradually veering back to N. E. at noon, when in latitude 19° 21′ N. and latitude 118° 22′ E. and continuing so, with squally unsettled weather, till the 13th, when the land was made.

There are no Barometrical observations with this log, and it is therefore very uncertain if these storms were rotatory ones, or, though so early in the season, the effect of the monsoon's setting in heavily, which by the weather they had to the Coast of China, I should incline to believe it was. The veering of the wind from N. E. to N. W. at first inclines us to believe, that it may be part of a circular storm, but as it never came farther to the Westward than N. W., I am upon the whole inclined to believe, that the whole was the conflict of the two monsoons, rather than the effect of rotatory storms, and I have not therefore marked even a conjectural track for these. We shall see in 1837, Track No. XXV. in the log of the *Ariel*, another instance of this sort of *vibration* of a heavy monsoon between N. W. and N. E. at its first setting in.

TRACKS No. XIII. AND XIV.

Tyfoon of 8th and 9th August, 1829.

Documents from the India House, and from Colonel Reid's Work.

9th August, 1829.—A strong tyfoon, though of short duration, was experienced at the entrance of Canton river, by which the H. C. Ship *Bridgewater* was driven on Lintin Sand and dismasted. The *Herefordshire* also at anchor, in company with her, fortunately rode out the storm in safety. Three other ships, the *Charles Grant, Lady Melville,* and *Buckinghamshire,* also bound to China, were about on the meridian of Canton, and in latitudes from 16° to 19° N. They also experienced bad weather on the 8th and 9th ; but, as I shall subsequently shew, this was certainly not the same storm, though Col. Reid, to whom an incorrect copy of the *Charles Grant's* log had been given, supposes it might have been so.

Abridged Log of the H. C. S. BRIDGEWATER, *Captain T. Manderson, civil time. From Col. Reid's Work, p.* 277, *of 2d edition.*

9th August, 1829.—At anchor with Lintin Peak N. ½ W. Peak of Lantoa S. E. West Point of Tungcoa N. EbE. ½ E. Wind, first part variable from Northward and squally. 2 A. M wind Northerly, and Barometer falling fast. at 8 A. M. Barometer 26.30, and on the decline. At 9, wind marked Easterly blowing hard, and veering to the East; let go a second anchor at 10, wind E. S. E. Violent gusts, parted the small bower, let go the sheet, riding with two cables out upon each anchor. Noon. Barometer 29.17, with very thick weather, tyfoon increasing, bent the small bower to the spare anchor; preparing to strike yards and top-masts. Having driven into four fathoms water on the edge of Lintin shoal, after consulting the officers, cut away the masts, brought up in three and half fathoms in soft mud. P. M. wind decreasing, midnight moderate.

10th August.—1 A. M. wind marked S. E. with passing squalls and rain.

Abridged Log of the H. C. S. HEREFORDSHIRE, *Captain Hope, civil time.*

From the India House.

Sunday, 9th August, 1829.—At anchor, Lintin Peak N. N. W. the *Bridgewater* in company, first part a fresh breeze from the North, increasing in the middle part to a most severe gale, with tremendous heavy gusts. At 3 P. M. gale abating very fast. At 11 A. M., observed the *Bridgewater* driving at times till 1 P. M. At half past 2, saw her with all her masts gone, sent our boat on board of her, and found she had three and half fathoms water alongside. Throughout the gale cloudy weather, with heavy rain.

Extract of a letter from Mr. E. Ford, then Chief Officer of the HEREFORDSHIRE.

From the India House.

8th August, 1829.—Anchored in the Chinese waters, Lintin bearing N. N. W., weather remarkably close and sultry. In the night, a fresh breeze sprung up from the North, which drew round to East, increasing towards noon, (on the 9th), to a most severe gale, with tremendous heavy gusts, so much so, that the *Bridgewater* was driven on shore. At 3 P. M. gale abating. At 6, moderate and fine weather.

Barque INNORE *in Macao Roads, civil time.*

Sunday, 9th August, 1829.—Had dark squally appearance from the N. E. At 2 A. M. hard squalls. At 4, making preparations for a tyfoon. At 11, being fouled by a Portuguese brig, slipped to run into the harbour, but at noon grounded. P. M. clearing up. Midnight, wind East, with cloudy weather.

Abridged Log of the H. C. S. LADY MELVILLE, *Captain R. Clifford, bound to China, reduced to civil time.*

From the India House.

8th August.—At noon latitude 17° 30′ N., longitude 114° 2′ E. P. M. wind N. W. by W., freshening to a strong gale at midnight, when it was at W. by S.

9th August.—6 A. M. struck top-gallant-masts. At 10 A. M. wind S. S. W. more moderate. Noon latitude account 19° 14′ N., longitude 114° 15′, P. M. S. S. W. fresh breeze. At 5, S. by E.; a heavy swell throughout.

Abridged Log of the H. C. S. CHARLES GRANT, *civil time.*

From Col. Reid.

In the communications from the East India House, I am referred to Col. Reid's work for this log. As remarked p. 654, Col. Reid has been apparently misled by the log of the *Charles Grant* having been sent to him as if kept in civil time, whereas it was really kept, like that of the *Lady Melville*, now before me, in nautical time; for the latitudes, as will be seen agree within 5′ (one ship being probably that distance ahead of the other at noon,) and if the A. M. and P. M. in the first column of the log printed in Col. Reid's works be changed, the winds will then agree, as recorded by the *Lady Melville's* log just given.

8th August, 1829.—Light airs S. by W. to N. W. by W. Noon latitude 17° 35′ N. Barometer 29.55. Thermometer 85°. *Lady Melville* in company, P. M. wind N. W., and at 11 P. M. N. W. by W., freshening to midnight, when the fore and mizen top-sails were handed.

9th August.—1 A. M. wind marked West. 4 A. M. W. by S. Noon no observation. Bar. 29.40. Ther. 83°. Nothing further recorded.

Abridged Log of the H. C. S. BUCKINGHAMSHIRE, *Capt. Glasspoole, bound to China, reduced to civil time.*

From the India House.

8th August, 1829.—Noon latitude by account 16° 4′ N., longitude 113° 37′ E. Wind at 4 A. M. West, 5 and 6 knot breeze. P. M.,

W. N. W.* 5 P. M. W. by N. moderate, but threatening. At 9, wind West, at 10 W. by S., Midnight W. S. W. increasing; ship going 7½ knots to the North.

9th August.—A. M. fresh gale with squalls and rain, and much lightning to the S. E., wind not marked. 6 A. M. under bare poles with hard gusts and heavy rain. 7, set the main-top-sail. 8 A. M. wind S. W. by W. At 10, set fore and mizen-top-sails. 11, wind S. W. by W. At noon S. S. W., latitude observed 18° 25′ N., longitude 114° 4′ E.

I have before observed, that these logs appear to me to relate rather to two storms, and I now proceed to shew why I think they do so, but to afford my readers the same means of judging which I have had, I give here the log of the *Lady Melville,* and a comparative table of the winds and weather experienced by all the five ships.

Log of the H. C. S. LADY MELVILLE, *Capt. R. Clifford, bound to China, nautical time.*
From the Records of the East India Company.

H.	Courses.	K.	F.	Winds, &c	Sunday, 9th August, 1829.
1	N.bE. ½ E.	6	..	N.W.bW.	N.B.—On the 8th Aug. at noon, lat. 17° 30′ N., long. 114° 2′ E.
	N.bE.			Fresh breeze down royal yards, in 1st reef topsails.	First part increasing breeze, middle strong gale, more moderate toward latter part.
	.. .. .				
	.. .. .				
	.. .. .				
	N.bE. ½ E.				
	.. .. .			Cloudy. ..	6 A.M. the ship pitching heavily, sprung jib boom, split main topsail, furled it and fore topsail.
	.. .. .				
	N.bE.			Freshening, close reefed topsails, down top gallant yards, W.bS. ..	
11	N.bW.				
12					
1					
2					
3					
4					
5					
6					
7	North.			Struck top gallant masts, in flying jib-boom. ..	
8	N.bE.				
9	..				
10	N.bW.			S. S. W. set foresail & fore & mizen topsails 3 reefs. ..	
		7 109			Lat. account 19° 14′ N. Long. account 114° 15′ E. Bar. 29·40. Ther. 83°.

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* MSS.—N. W. which evidently wrong, the courses being marked N.½E., N. by E., and North to midnight.

H.	Courses.	K.	F.	Winds, &c.	Monday, 16th August, 1829.
1	N.bW.	7	4	S.S.W. Hazy...	First and middle parts a fresh breeze, latter more moderate, with squalls, rain, and heavy swell throughout.
2	.. .. ..	7			
3	.. .. ..	7			
4	.. .. ..	7			
5	.. .. ..	7	..	S.bE. up top gallant masts and yards, out 3d reefs, cloudy.	
6	.. .. ..	6	4		
7	.. .. ..	6			
8	.. .. ..	6	4		
9	.. .. ..	7			
10	.. .. ..	7	..	Crossed royal yards.	
11	.. .. ..	6	4		
12	.. .. ..	6	4		
1	.. .. ..	7	4		
2	.. .. ..	8	..	Squally and rain	
3	.. .. ..	8			
4	.. .. ..	7	4		
5	.. .. ..	7	..	Out reefs. ..	Saw the land from the mast head, bearing N.N.W.
6	.. .. ..	6	4		
7	.. .. ..	6	4	E.S.E.	
8	.. .. ..	6	4		
9	.. .. ..	6	4		
10	.. .. ..	3	4	Variable, squally & rain.	
11	.. .. ..	7			
12	.. .. ..	7	4		

Comparative Table of the Winds in the Tyfoons of 8th *and* 9th *Aug.* 1829.

Date Civil Time.	Bridgewater an Herefordshire. Lintin.	Lady Melville.	Charles Grant.	Buckinghamshire.
	4 A.M.		.. .. ..	West.
	Noon, . ..	17·30 N. 114·2 E.	17·35 N...	16° 4′ N. 113° 37′ E.
	1 P.M. ..	N.W.bW.	.. .. ..	
8th Aug. 1829.		freshening.	N.W. ..	N.W.
	5			W.bN.
	9			West.
	10			W.bS.
	11		N.W.bW.	
	Midnight,	W.bS.		W.S.W. increasing.
	1 A.M.		West, ..	
	2 Northerly. ..		.. ..	
	4		W bS.	
	6	Struck top. gal. masts.		Bare poles.
9th Aug. 1829.	10 E.S E. Tyfoon,	S.S.W. made sail.		W.bW. making sail again.
	11	. .. ..		S.W.bS. moderating.
	, ..	19 14 N. 14·15 E.		S.S.W. 18·25 N. 114·4 E.
	1	S.S.W. ..		
	2 A.M. moderating	.. .. ..		
		S.bE. ..		
10th Aug.	1 A.M. S.E.			

First, we will take the Lintin records. From these it is clear, that the storm there may be called one lasting about 6 hours only, *i. e.* from 9 in the morning to 3 in the afternoon of the 9th, and during this time, as remarked by Col. Reid, being from N. E. to East, E. S. E., and S. E. We may thus take it to be at noon on the 9th at its full fury at E. S. E. when the centre must have borne about S. S. W. from the *Bridgewater* and *Herefordshire,* and by 3 P. M. it was at S. E., when the centre was of course bearing S. W. from them, and they were then nearly out of its influence; for it is stated, that the boat of the *Herefordshire* was sent on board of the *Bridgewater* at ½ past 2 P. M. Now the bad weather from the N. W., West, and S. W., which was experienced by the other three ships, *i. e. Charles Grant, Lady Melville,* and *Buckinghamshire,* began with those ships before midnight, between the 8th and 9th; and at 1 A. M. on the 9th, when it should be noted that the wind was at least West, and to the Southward of West with some of them. The centre then at midnight, between 8th and 9th, should have borne North from them, and as the wind was about S. S. W. by 10 A. M., the centre bore W. N. W. from them at that time, and they were all not far from the meridian of Lintin. The *Lady Melville* indeed was making sail again at this time. Yet it was at 9 A. M. that the storm was *commencing* with the *Bridgewater,* say from the E. by S., which would give the centre bearing S. by W. from her, and from its violence and fall of the Barometer, much nearer to her than to the ships at sea; and at 10, when, as we have noted, they were making sail with a S. S. W. wind, it was blowing a tyfoon at E. S. E. at Lintin. No projection will reconcile this, and no allowances from the anomalies produced by the land, will account for the discrepancies in time, I think. We know that the ships at sea had nothing to alter the fair course of the storm, but as will be seen by the chart, the high land on the Eastern shore of the river, and that of the large island of Lantao, may have greatly influenced the direction of the wind.

Again, if the storm experienced by the ships at sea had occurred *later* than that at the anchorage, we might suppose it to have been, as in the instances of the *Ariel* and *Marquis Camden,* a disturbance or *vibration* of the usual monsoon, (this being the height of it,) occasioned by the storm to the Northward; but it does not seem so probable that this disturbance preceded the tyfoon, not at least by so great an interval of time as from ten to twelve hours.*

Upon the whole, then, I should be inclined to suppose, that there were two storms, of which the centre of that of the ships at sea, bore North from the *Charles Grant* and *Lady Melville,* at 1 A. M. on the 9th, and as it was not severe, and not felt at Lintin, it was probably of small extent. I have then marked a conjectural track for it in No. XIV., from S. 78° E. to the N. 78° W., and those who study the subject, will agree with, or dissent from my views as they please. I have laid down the Lintin storm as coming from East, the height of it appearing to have been about noon, when the centre would have borne S. S. W. from the ships; but this is almost conjectural, for amongst high rocky islands like those at the entrance of Canton river, the wind may have been modified in many ways. The storm of the ships at sea I have laid down as passing from the E. S. E. to the W. N. W., though from the absence of any registry of the Barometer, except at noon, we cannot say when the storm fairly began or ended; but with due allowance for the run of the ships in the interim, I think it may be taken as far to the Southward as this.

The WATERLOO'S *Storm.*

Document from the East India House—Mr. Packman.

26*th August,* 1829.—The H. C. S. *Waterloo* appears also to have been within the range of one of those E. S. Easterly storms, about a degree farther to the Southward, than the ships in the former article. The following is the memorandum sent me, but I have not marked a conjectural track from it, as no other document has been obtained relative to this storm, which indeed we could scarcely notice as one, but for the remarkable fall of the Barometer.

H. C. S. WATERLOO, *in the China Sea.*

26*th August,* 1829.—A brisk monsoon in the first and middle parts with squalls and rain, in the latter variable from the N. W., and cloudy weather. Lat. observation 14° 15′ N., long. per Chron. 113° 29′ E. Thermometer 83°. Barometer 29.75.

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* Even supposing the storm to have come from the N. E. still it cannot be reconciled, as to distances from the centre and intensity, with the times, so that all things considered, two separate storms is the most probable supposition.

27th August.—Variable wind, but mostly from the N. W. with squally weather and rain throughout. Lat. 15° 21′, long. 114° 01′ E. Thermometer 81½°. Barometer 29.64.

28th August.—Variable winds from the North and N.E. with squally weather and heavy rain and lightning from the Eastward in the middle part. Latitude observation 15° 36′ N., longitude per Chron. 114° 50′ E. Thermometer 83°. Barometer 29.50.

29th August.—Variable N. W. winds in the first part, veering round to the S. W. and South in the middle and latter, and increasing to a fresh gale with frequent squalls and rain; following days strong and pleasant breezes from the S. Eastward till our arrival at China. Latitude observation 16° 29′ N., longitude per Chron. 115° 06 E. Thermometer 82°. Barometer 29.25.

TRACK No. XV.

Tyfoons of September, 1831.

Documents from Mr. Redfield and the India House.

The year 1831 seems to have been one in which several tyfoons were experienced in the China seas. We have records, though imperfect, of one in September, and of two in the month of October. The following is Mr. Redfield's abridgment from the Canton papers of the notices then published. I have but one memorandum of this storm from the India House, with, however, a very useful note appended to it by Captain J. K. Forbes, of the H. C. S. *Thames.*

Canton Tyfoon of September 23d, 1831.

The American ship *Galen,* from the Sandwich Islands, bound to Canton, encountered bad weather off the Bashee Island on the 21st of September, and on the 23d, near the Lema Islands, lost her mizen mast, fore and main-top-masts, &c.

The British barque *Agnes* from Singapore, also lost her fore-mast on the 23d, and was obliged to cut away the remaining masts. She was at anchor on the 27th, about nine miles Southward of the Grand Ladrone.

H. C. Ship *Hertfordshire* and Danish ship *Norden*, arrived on the 25th [from the Southward] and experienced no bad weather; the latter reports that on the 24th, a very violent swell was running down from the North-eastward, but the barometer indicated no change, and neither of these vessels were aware of the tempest till their arrival at Macao.

At *Canton* early in the morning of the 23d September, commenced a *hard northerly gale,* which continued without intermission for twenty-four hours. The tide rose to a great height, and much damage was sustained; an official return to the authorities at Canton states, that after it was past, *one thousand four hundred and five* dead bodies were picked up along the coast. The gale was far more severely felt at *Macao* and Kumsing-moon, where it is described as having been truly dreadful.—*Canton Papers.*

We may fairly deduce this to have been a storm of small extent, running down the South Coast of China, about parallel to our Track No. I, which course I have therefore assigned it as a conjectural one, marking it No. XV.

At Whampoa, on the 23d September, 1831.—A severe tyfoon was experienced in China, in which several vessels were lost, and great mischief done on shore. At Whampoa, where it was severely felt, the wind, says Captain Forbes, H. C. S. *Thames,* drew round from N. to E. and S. E., but was not of such violence as to be called a hurricane there.

Captain Forbes adds here a valuable note as follows :—

NOTE.—I would here beg leave to mention a circumstance, which may be useful in a practical point of view on such occasions. I left the H. C. S. *Thames*, (which I then commanded,) at Whampoa, on Sunday evening the 18th September 1831, to proceed to Macao in the ship's launch, arriving there next day. Before leaving the ship, I happened to look into *Horsburgh's Directory,* page 10, of the " Introduction and general remarks upon winds, &c. article ' Change of the Moon'," and said to be written by an *ingenious Frenchman.* By the rate there laid down as to the chances of hurricanes, I found that there was a great chance of one at the time it actually occurred at Macao, (on the 23d September,) so I ordered two large anchors and cables to be put into the launch, instead of those in common use. By this, I unquestionably saved my boat, and probably her crew, besides another ship's launch which broke adrift, and was saved by holding on by the *Thames*'."

Storm of 5th and 6th October, 1831.

Notes from the East India House.

5th October.—H. C. Ship *Farquharson,* Captain Campbell, lying at Whampoa, had a strong gale from the *Westward** with severe gusts. Weather too severe for a craft to lie alongside.

6th October, 1831.—H. C. S. *Lowther Castle,* at anchor in Whampoa reach. A severe gale commencing at North, veering round to the East, and then moderating, with incessant hard rain throughout. Barometer fell to 29.17.

TRACKS No. XVI, XVII, AND XVIII.

MANILLA, PANAMA'S *and* FORT WILLIAM'S *Tyfoon of 23d, 24th, and 25th October,* 1831.

Documents from Col. Reid, Capt. Biden, and the Voyage of La Place.

Between sun-set of the 23d, and sun-rise of the 24th October, 1831, a tremendous tyfoon was experienced at Manilla, in which almost all the ships at Cavite, and those lying at the bar, before Manilla, were driven on shore. The American ship *Panama,* and the English ship *Fort William,* also experienced severe storms in the China seas, about the same time. I have first given their different logs, reduced to civil time where necessary, and then a table from which I should deduce, that the Manilla storm, and that of the *Panama,* were undoubtedly one storm, but that of the *Fort William* a different one.

Log of H. M. Frigate CROCODILE, *Captain R. Bancroft, in Manilla Bay. Abridged from Col. Reid's Work, p.* 284, *2d edition.*

Civil time.

23d October, 1831.—Sun-set, increasing breeze and cloudy, veering more Northward from the N. E., at which quarter it had previously been. At 7, veered to 75 fathoms. At 8: 30, down top-gallant-masts, and let go the best bower. At midnight very severe hurricane, with heavy rain and high sea, bent the sheet-cable over all, not being able to get it out of the hause hole.

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* This date and the wind at West, are so in the MSS. before me, but both are contradicted by the next extract, a memorandum from the *Lowther Castle's* log, in which the wind, at all events, is probably right.

24th October.—A. M. wind marked N. by W., tyfoon very heavy, with incessant rain and high sea. At 1h. 40m. its extreme rage abated, and shifted to the N. E., the sea became less violent, and the ship rode more easily, but very heavy squalls. No Barometrical observations are given.

Tyfoon of 27th October, 1831,* *at Manilla.*

Abridged from the Notes to the Voyage of La Favorite, *Capt. La Place, Vol. I. p.* 552.

27th October, 1831.—One of these hurricanes ravaged the Colony in a frightful manner. It began at midnight, and lasted four hours. The wind began at N. N. W., and ended at E. N. E. When at North the tyfoon blew with a fury, which no inhabitant had ever seen equalled. The air " seemed on fire." All the vessels at anchor before Manilla and at Cavite went on shore, and were mostly lost. The English Frigate *Crocodile* only, with excellent chain cables, and in about the same anchorage as the *Favorite,* held on, and sustained but trifling damages. The destruction on shore was frightful.

At the Laguna, (thirty miles East of Manilla,) the hurricane was still more severe, though sheltered by high mountains to the North.

M. La Place remarks also, and this is a fact well known at Manilla, the evident relation which the volcanoes have with the hurricanes. Scarcely one occurs in which some volcanic phenomena are not observed, and these are sometimes very violent.

Log of the Ship Fort William, *reduced to Civil time.*

From Captain Biden.

The ship *Fort William,* Captain Neish, bound from China to Manilla, arrived at Singapore on the 12th instant, under jury masts, having been totally dismasted in the passage, probably by the Manilla tyfoon. We have been favoured with the following abstract of the log of that ship, which details the particulars :—

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* There is a difference of dates here, but there is no doubt the storms are the same.

Abstract from the Log of the Ship FORT WILLIAM.

" *Sunday,* 23*d October,* 1831.—Our Canton Pilot left the ship, when we hauled to the Eastward, being bound to Manilla."

Monday, 24*th Oct.*—At 8 A. M. passed between the Asses' Ears and the Lema. Strong breezes and cloudy weather from the N. N. E., double-reefed the top-sails and reefed the main-sail. At noon, strong breezes and increasing sea. No land in sight.

P. M. Blowing strong, and sea still increasing; sent down the top-gallant-yards and masts, wind N. E.; steering E. S. E. At 11 P. M. hard squalls and high sea; clued up the top-sails to close reef them. Midnight, weather getting worse, furled the top-sails, and struck top-gallant-masts.

25*th October.*—At 4 A. M., a sea struck, and carried away the starboard quarter cutter. Daylight blowing a perfect hurricane; furled the main-sail. Noon, hard gales and thick drizzling rain. No observation.

P. M. Blowing a dreadful gale, with violent squalls; the sea still increasing. At 8 P. M. the main-mast went over the starboard side, about 14 feet above the deck, and the mizen-mast immediately followed, falling nearly right aft on the poop, the top just clearing the stern, carrying away with it the larboard quarter cutter, stern boats, davit, &c. &c.; cut away all the wreck with every possible despatch, and soon got clear of it. During the night the gale still continued, and the ship labouring excessively, expected the fore-mast to go every moment.

26*th October.*—At 4: 30 A. M., the fore-top-mast went, and at 8, perceived the fore-mast badly sprung under the fore-castle. Several of the chain-plates and shrouds gave way, the fore-mast immediately went over the larboard bow, sprung the cat-head, and carried away the head rails, bumkin, &c. &c., and struck the ship a violent blow under the water, which shook her, as if she had struck a rock. Cut away every thing, and got clear of all the wreck without, (we hope), seriously injuring the hull, and she made no water, and now being obliged to choke the rudder amidships, for which we had been under very great apprehension during the whole gale. Noon, gale abating, and sea still very high. No observation. Ship labouring so excessively, that we dare not cast loose the booms to prepare jury-masts.

27th October.—Fine weather; latitude observation 18° 25′ N., longitude 114° 31′ E.

28th and 29th Oct.—Ship again under command of her helm, and found that we could just weather the Paracels and Bombay Shoal, with a steady Easterly wind; resolved to make the best of our way to Singapore.

November 2d.—Passed in sight of Pulo Sapata.

Saturday, 12th Nov.—Arrived safe at Singapore.

Storm raged in lat. from 21° to 18° N., and from long. 114° to 116° E.

During the whole of the tyfoon, the Marine Barometer never fell below 29.60."

The following is the account of the *Panama's* part of the storm, as given by Mr. Redfield:—

" *Extract from the private Journal of Wm. F. Griswold, Esq. Master of the ship* PANAMA, *on a voyage to Canton, October,* 1831.

October 23d, (Nautical time,) lat. 9° 17′ *N., lon.* 117° 16′ *E.,* wind came out at southward and continued until 10 p. m., then died away and commenced from the Northward with a heavy head sea. Forenoon, breeze from N. W. and clear weather. *Latitude* 9° 45′ *N., longitude* 117° 25′ *E.*

October 24th.—Pleasant breezes from N. W., and hazy steady weather. A sea rolling from the Northward. I suppose there has been a gale in the China sea, which has not yet reached us. Evening, wind rapidly increasing and Barometer falling from 29.75 to 29.40. Midnight reefed top-sails.—9 a. m. double reefed do.—barometer 29.20. Ends with tremendous gale from the westward and heavy sea—barometer 29.10. *Lat.* 11° 15′ *N., long.* 118° 20′ *E.*

October 25th.—Heavy gale W. S. W.—barometer 29.05 Gale hauling to the southward. Evening more moderate. Made a little sail. Wind at 7 p. m. from south-westward; 11 p. m. from southward. In the morning at 5 o'clock the wind came out at S. E. (barometer at 29.10) and blew a perfect hurricane. Hove to under mizen staysail; barometer at 1 p. m. 29.05, 4 *p. m.* 29.00, 7 *a. m* 29.10, 8 *a. m.* 29.20. I believe this fall of the Barometer to be, in this latitude, very remarkable.

This gale was on the 24th and 25th October, civil time, and from its peculiar features and double fall of the barometer, there appears something like the falling in of two hurricanes on the same track. It was, doubtless, in whole or in part, the same hurricane that visited Manilla on the night of the 23d of October, and which is noticed by Col. Reid. The irregularities of the storm *may* have been caused by its passage over the Philippine Islands, the Panama being then off the

Strait of Mindoro, and about 210 miles from Manilla. I have deemed it not improbable, that this storm was the same that visited the Bay of Bengal on the 31st of the same month, and was so destructive at Balasore, and on the neighbouring coast. The course from the Panama's position to Balasore is about N. 73° W., and the distance, say 1920 miles, which would give a rate of progression of 11½ nautical miles per hour: which coincides with other storms which have formerly been examined. It is important to ascertain if this storm crossed the Burman empire, immediately previous to its appearance in the Bay of Bengal."

Comparative Table of the Winds and Weather in the Manilla Tyfoon of 23rd October, 1831.

Date.	H. M. Fr. Crocodile & Fr. Frigate Favorite, Manilla.	Ship Panama.	Ship Fort William.
23rd Oct. 1831.	By midnight a Tyfoon from the North, veering from N.bW. and N.N.W. to N.E. ..	Noon 9·17 N. 117·16 E. five P.M. pleasant breeze N. W. & heavy Northerly swell. Evening increasing, Barometer 29·40 from 29·70.	Left the land, strong breezes N.N.E. and cloudy weather.
24th Oct. 1831.	A.M. N.bW. ending at N.E.	9 A.M. Bar. 29·20. Noon tremendous gale from West. Bar. 29·10. Lat. 11·51 N. Long. 118·20 E. P.M. W.S. wind. Bar. 29·05. 7 P.M S. Westward 11 P.M. &c.	Noon no land in sight. P.M. blowing strong from N.E. Midnight gale N. E.
25th Oct. 1831.	.. .. ..	5 A.M. wind S.E. Bar. 29·10. Hurricane 1 P.M. Bar. 29·05, 4 P.M. 29·00, 7 A.M. 29·10. 8 A.M. 29·20.*	Daylight a hurricane. P.M. dismasted. Noon 26th abating. 27th, 18.25 N. 114·31 E.

If we carefully consider the foregoing Table, we shall I think agree with Mr. Redfield in thinking, that the Manilla storm and the first of those of the *Panama* were undoubtedly the same, and that it was travelling up from the E. S. E. through the Straits of Mindoro upon about a W. N. W. course. The *Panama's* second storm, which it will be noted was from the S. E., may have been the N. E. quadrant of another storm crossing Palawan, or it may have been an irregularity caused by the junction of the *Fort William's* and the Manilla storm.

A.M. in Mr. Redfield's pamphlet, P.M. is I suppose meant.

For, as to the *Fort William's* storm, she may be said to have been driven in it on about a S. by E. course, from latitude 25° to latitude 19°. and to have been dismasted about latitude 20°, with the wind at N. E., while the *Panama,* which vessel could not have been in more than 13° 30′, or at most 14° N. had her second storm at S. E., being then at least seven degrees to the S. E. by S. of the *Fort William.* If the storms were the same, the *Panama* should have had the wind S. Westerly, for a S. Easterly wind would require her to have been nearly on the same parallel as the *Fort William.* If the storm had been one also travelling up from the S. E. by S., or S. S. E. *towards* the *Fort William,* it might, it is true, have been, as it was, a tremendous gale at N. E., but at its close it would have veered or shifted to N. W. or S. W., according as the centre passed to the East or West of her position. Nothing of this sort occurred, and it is therefore clear, that the *Fort William's* was a separate storm at N. E. and veering to the Eastward, sufficiently to enable the ship to bear up for Singapore when disabled: whether it was a circular storm, or only the monsoon setting in late with a heavy gale, we cannot, in the absence of the Barometrical observations, decide.

We have unfortunately no records from any ship which might have been at this time in the intervening space between the *Panama* and *Fort William,* or say about latitude 17°, and not far from the meridian of the Macclesfield Shoal. If we had, I think it not improbable, we might have found that the coalition of the two storms might produce a third with a curved track, like our Nos. III. and XXIII.

It is at all events some corroboration of them to find, that the forces which *might* produce such curved tracks have occurred.

I have, then, with these views, assigned an E. S. E. to W. N. W. track, No. XVI., for the Manilla and *Panama's* first storm, a conjectural one No. XVII. from the S. E. to the N. W. for the *Panama's* second storm, and one No. XVIII., (also conjectural, because it *may* have been the monsoon, and our data are imperfect), for the *Fort William's* storm.

TRACK No. XIX.—TYFOONS OF 1832.

Documents from Mr. Redfield, Captain Biden, &c.

There appears to have been also during this year two severe tyfoons in the China seas in this year, the one in August, and the other in

October. The following is from the Chinese Repository of August, 1832:—

Tyfoon, 3d August, 1832.

2d.—Evening, wind from Northward. Thermometer 92° and Barometer beginning to fall from 29.60 or 70, but not much wind during the night.

At daylight of the 3d, wind fresh. Barometer fell till it reached 28.10, (with some 27.90). In 1809, (*True Briton's* storm,) it fell to 28.30 only. This storm was far more severe, and was much longer from the North. A Dutch vessel sunk between Lintin and Macao. The *Spartan* driven to sea, saved about 40 of her crew. The tyfoon appears to have extended fully 200 miles from N. to S.

Mr. Redfield has collected the following notices of this storm:—

Canton Tyfoon of August 3d, 1832.

At *Macao* the wind set in from the *north,* and reached its greatest height about 1 p. m.; continuing with the same violence till 5 p. m., when it *veered suddenly to the southward,* but with diminished strength. When the fury of the gale was exhausted, the quicksilver rose at the rate of three-tenths per half hour. *Barometer, August 2d, 8 a. m.* 29 68;—*8 p. m.* 29.34;—*Aug. 3d, 8 a. m.* 29.34;—*5 p. m.* 27.88. Other land barometers differently adjusted, fell to 27.96 and 28.05.

At *Cap-shuy-moon* the gale began at N. and N. W., between which points it blew with tremendous violence; shifting, towards the conclusion to S. E., whence it blew more moderately. The *Barometer,* in the early part, *fell to* 28.20.

The American ship *Don Quixote* left on the day before the tyfoon; and returned on the 5th with loss of mainmast.

Since the tyfoon, the British brig *John Biggar,* from Manilla, has come in dismasted. The Spanish brig *Veloz,* also from Manilla, has arrived with loss of mainmast.

A letter from the commander of the Dutch ship *Fair Armenian,* which foundered about thirty miles westward of the Grand Ladrone, says:—"On the evening of the 2d instant, we made the Grand Ladrone, and on the morning of the 3d, it came on a tyfoon blowing off the land; this about noon increased to a tremendous height and dismasted us; unshipped and broke our rudder, and carried away a great part of the bulwarks. The gale was at its height about 4 or 5 p. m., and after dark gradually moderated."

The *Edmonston*, *Caledonia*, *Esperança* and *Italy* have come in without damage. The *Caledonia* on the 3d, when in *latitude* 17° *N.*, *longitude* 113° 50′ *E.*, experienced a *strong gale from W. veering to S. W. and S.*, with a heavy and confused sea. *The barometer fell to* 28.50. The *Edmonston*, on the same day, when within seventy miles off the land, felt the *same weather*, which brought her under bare poles for four hours.

At the *Bocca Tigris*, the weight of the tyfoon, which in *Canton and Whampoa ranged from N. to N. E.*, was felt about 4 or 5 p. m.; the *barometer standing at* 29.10. About 6 p. m. the quicksilver rose, and the gale began to abate.

At *Canton*, *August*, *3d.* Blowing hard at N. and N. E., with violent gusts; *barometer* 29.15; and for the most part rain. *August 4th.* First part blowing hard, *wind S. E. barometer* 29.70;—middle and latter parts strong breezes and fine weather.—*Canton papers of August*, 1832.

Extract from the Journal of an American Shipmaster, bound to Canton. "August 2d, 1832, (nautical time,) *latitude* 18° 34′ *N.*, *longitude* 114° E.; *barometer* 29.56. First part light and baffling winds *from E. to N. E. and N.* and hazy:—middle part the same:—At 4 *a. m. calm*, *barometer* 29.59:—At 4-30 a. m. a breeze sprung up from W. N. W.;—made all sail by the wind. Latter part and end, strong W. N. W. wind and rough head sea. Took in the royals, flying-jib, and fore and mizen-top-gallant sails. *Bar. at noon* 29.40. The weather, however, looks very fine, and the breeze is steady at W. N. W. *latitude* 19° 54′ *N.*, *longitude* 130° 50′ *E.*

August 3d commences with a strong steady breeze at W. N. W. and hazy weather, barometer falling fast. At 2 p m. down to 28.98, but not the least unfavorable *appearance* in the clouds, sea, or weather. [The ship was at this time running into the path of the gale, from its southern side.] I must acknowledge that the rapid fall of the mercury, within the last ten hours, has alarmed me not a little, and we are now preparing for the worst of weather.—At 4 *p. m. barometer* 29.25 and the wind freshening; single reefed topsails. The old tars who have seen sail carried on this ship through thick and thin in the stormy regions of the southern ocean, now look at each other with amazement at such preparation for apparently nothing. Towards evening the weather begins to look unfavorable; the sun went down in a body of clouds, deeply tinged with red; not the rich and variegated tints that give rise to pleasurable sensations to all who look upon them, but the fierce, glaring, angry red that creates distress in the bosom, particularly of a mariner. After sunset the moon (at the 2d quarter) could be seen at intervals through the clouds that are driving *from the N. E.* at the rate of twenty knots, and the lightning *shooting up* from every point of the compass. *At* 8 *p. m. barometer* 29.15. Took in all sail, but the close reefed fore and main top-sails and fore-top-mast staysail; the wind still steady at W. N. W. Sounded in 45 fathoms, the *Grand Ladrone bearing N. N. W.* 38 *miles.*

At 10 *p. m. the wind suddenly shifted to W. N. W.* [N. N. W.?] *in a squall.*—Heavy rain and distant thunder until 5 a. m.:—*Had continued shifts of wind all round the compass.—At* 7 *a. m.* a steady gale very severe, from about N. W. and constant rain:—hove to under the reefed main-top-sail:—*At* 8 *a. m. barometer* 29. ! !—Latter part and end, the real genuine, unadulterated Chinese *Tyfoon;* a steady roar and constant rain; took in the main-top-sail.

August 4th. (P. M. of 3d.) The first quarter of this day extremely severe gale and thick weather.—*At* 2.30 *p. m. barometer* 28.88; shortly after which it began to rise:—*at* 6 *p. m.* 29.05;—*at* 8 *p. m.* 29.08, and moderating—During the night, *hard gale from N. W. to W. S. W.* and torrents of rain.—*At* 4 *a. m. wind S. W to S. S. W.* and hazy:—made sail and by 5 a. m. had royals and studding sails set. During the day passed a number of wrecks, and when we arrived, (5th,) found that the hurricane had been very severe, and caused immense destruction."—*New York Journal of Commerce.*

I have given these logs as they stand in Mr. Redfield's pamphlet, but I should be inclined to think, that the *Caledonia's* storm might be nothing more than a monsoon gale, of which we have so many examples, and which like those of the Bay of Bengal, may be more liable to happen when a circular storm is travelling across in the leeward part of the Bay or sea.

The "American ship master" whose name is not given, seems to me, when he experienced his shift of wind at 10 P. M. of the 3d, to have been just on the limit between the Macao tyfoon and the monsoon gale of the *Caledonia,* for it was certainly not the centre, which at 5 P. M. was at Macao, and if it had travelled to the Southward to reach the American ship, would have left that place with a gale from the N. E., or S. E., or East, whereas by taking the Macao tyfoon to have extended to about this latitude only, which gives it a semi-diameter of 75, and consequently a diameter of 150 miles, and the *Caledonia's* storm as a moonson gale, the steady *breeze* at W. N. W. &c., which the American ship had in latitude 20°, (or half way between the *Caledonia* and Macao) until he ran into the Southward, half of the storm is clearly accounted for.

On these grounds, then, I have marked for this tyfoon, an East and West track, No. XIX. though it should be borne in mind, that it might really have been a point, or even more to the North or South of East and West, but we have no data, from which to say positively that it was so.

TRACK No. XX.

The MOFFATT'S *Tyfoon.*

The October tyfoon was experienced by the H. C. Chartered ship *Moffatt*, Captain Cromarty. The following is from a Singapore paper, and sent me by Captain Biden. I have here and there abridged those parts which are not essential to our research, and reduced the whole to civil time :—

Singapore, Thursday, 8*th November,* 1832.

The Company's Chartered ship *Moffatt*, Captain Cromarty, bound for China, put in here the day before yesterday, having lost her main and mizen-masts, and fore-top-mast, and having suffered many other injuries during a violent and protracted hurricane, which she encountered in the China seas within a very few degrees of her destination.

We have been favoured by the Captain with the perusal of the log-book kept during the period of the tempest, from which we are at liberty to give the following details of the various disasters which the ship sustained. The hurricane lasted five days :—

Monday, 22d October. Course E. by S.

" Wind N. E. by N. hard gales, vessel going under close-reefed top-sails. Furled fore and mizen-top-sails and courses, set the storm mizen and main-try-sails. At 11 P. M., heavy hurricane ; split the main-try-sail, and furled the main-top-sail. At 1 A. M., increasing hurricane, with much sea, the ship labouring very much, carried away the main-top-mast. At 2, a heavy sea struck the ship, and carried away the starboard quarter boat ; the wreck of the main-top-mast in swinging about stove the cutter, and injured the long boat severely. At 5, a dreadful hurricane ; the mizen-mast went by the board. At 9, the main-stay gave way, replaced it with much danger and difficulty. At 11, the hurricane continued, the ship labouring very much, and the sea making a continual break over her. P.M., wind veering from N. to East, hurricane still continuing, making every effort to get the wreck of the main-top-mast on deck ; the reefed mainsail got adrift, and blew to pieces. 4 P. M., ship labouring very much. The sea washing over the ship's deck incessantly. At 8, ship lurching very heavily, the main-mast went by the board. When the main-mast fell, one of the top-sail sheets got entangled with the waste anchor, and brought it right on deck.

23*d October*.—At 1 A.M., hurricane abating a little. At 5, hurricane still abating, but a dreadful sea, and the ship rolling very heavily. Carried away the fore-top-mast. At 11 and 12, weather moderating, set the foresail to endeavour to steady the ship, people employed in clearing the wreck. Lat. per observation 17° 9′ N., long. 113° 30′ E. P.M., wind from N.E. to E., employed clearing the wreck. At 7 P.M., hard gales with heavy rain, ship rolling very much, and shipping a great deal of water over all. One pump constantly going. At 10, severe hurricane, which continued until next morning.

24*th October*.—From the continued heavy rolling of the ship, almost every thing, both in between decks and hold got adrift, and it was almost impossible to stand on the deck. P. M., wind from N. E. to N. Hurricane continued throughout the day; the ship labouring very much, and requiring to be pumped every hour.

25*th October*.—Hurricane continued, pumping every hour; shipping great quantities of water over all. Noon latitude 14° 20′ N., longitude 109° 53′ E. At 5 P. M., finding the ship to have driven a long way to the Southward and Westward from the commencement of the hurricane, and also considering the disabled state of the ship, and impracticability in its present state of effecting a passage against a strong N. E. monsoon, bore up for Singapore." No mention is made of the barometer in this ship's log.

The Dutch ship *Esperançe* of Batavia, from China, is the only arrival since the gale."

As the *Moffatt* was bound to China, she of course stood to the N. W. as long as she could on the 22d with the N. E. by N. gale, and was then driven back when lying to and disabled, so as to be at noon on 23d in latitude 17° 9′ N., when the storm again increased and drove her to latitude 14° 20′, just clearing the Paracels; but from the winds veering *from N. to East* on the 23d, and then moderating before another storm set in, we should at first be inclined to take this for two storms, but it seems more probable, that it was one from the N. E. of very slow progress; and that the ship ran into it again by setting her fore-sail, and then drifted with it for a time; for had the storm passed her she would have had fine weather, and the wind probably from the S. E. We cannot say also if it was not, though so very violent, a monsoon gale, which the season might well admit of, and the want of Barometrical observations tends to perplex our judgment the more. I have therefore marked only a conjectural track from the N. E. for this storm.

1833.

TRACK No. XXI. *Storms of the Brigs* BEE *and* VIRGINIA.

Documents from Capt. Biden, and Capt. Willie.

We have records of two considerable storms in the China sea, in this year, of which one at least was a true tyfoon, I think. The first was a storm occurring in August, in which the brig *Bee* was lost, the brig *Virginia* bound up the China sea, narrowly escaping it; and the second was a storm experienced by the H. C. S. *Lowther Castle*, of which a memorandum was obtained for me from her commander, by the Hon'ble the Court of Directors. I give here the documents, with the usual abridgments.

Extract from the Log of Mr. Willie, Mate of the Brig VIRGINIA, *bound to China, reduced to civil time.*

26*th August*, 1833.—Light 3 and 4 knot breezes S. W. to S. E., steering N. E. and N.E.bN. At noon latitude 15° 44′ N. P. M. breeze decreasing to a calm at midnight.

27*th August.*—5 A. M. light breeze, N. N. W., all sail set. At daylight *a bank of heavy black clouds in the E. S. E.* At 8 moderate, breeze North and cloudy. Till noon veering between N. N. W. and North. At noon, fresh breeze N. W. and N. Latitude observation 16° 10′ N., longitude account* 114° 26′ E. P. M. increasing from N. W.bN., and at 7 P. M. N. N. W. At 8-30 squally and rain, preparing for bad weather. At midnight fresh gale at N. W., with heavy squalls and rain at times.

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* No longitudes are given in the Log, I have therefore, as the vessel's true position is of importance, worked it back from the Grand Ladrone.

28*th August.*—At daylight wind about N. W., thick stormy weather all round, with a heavy confused sea. At 9 A. M. increasing to a hard gale about N. W., at noon no observation. Latitude by account 16° 56′ N. longitude account 115° 26′ E. P. M. throughout hard gale with squalls and rain, veering from W. N. W. at 1 A. M., to West at 4, and S. W. at 7, wind *about* S. W.bS. at midnight.

29*th August.*—1 A. M. wind S. S. W., 4 A. M. South; daylight dark gloomy weather, scudding under bare poles with a heavy sea. Noon continued gale with thick cloudy weather. No observation. Latitude by account 18° 36′ N. longitude 115° 10′ E. P. M. wind Southerly throughout, weather moderating, squalls less frequent. Heavy confused sea.

30*th August.*—A. M. moderate, noon latitude observed 20° 8′, long. account 114° 17′. Ran N.bW. 86½ miles to—

31*st August.*—When at 8 A. M. Grand Ladrone bore North 6′ or 7′ distant.

Loss of the Brig BEE.

Copy of a Letter, dated Canton, September 21*st*, 1833.

I am truly sorry to announce to you the total loss of the good brig "*Bee*" and all her cargo, on the morning of 30th August, 1833, she having foundered with us, after a series of heavy gales and one tyfoon near the South Coast of China, in about latitude 21° 30′ North, longitude 112° 50′ East, about 15 miles off the Island of Huilingshan. All hands saved, except one man, who was drowned at the time she filled with water.

On the morning of the 28th August, we left the Capsing-moon, bound to New South Wales, in fine trim, and, I can safely say, every thing comfortable on board. We had hardly gone 20 miles, when it came on to blow very hard from the N. E., which obliged us to run to sea, and gain an offing before night, which we did, and at 6 P. M. hove to, a tremendous sea running at the time. We most fortunately rode out this gale very comfortably without any damage, and next morning, 29th August, it began to moderate a little, and the wind hauled round to the Southward, which was a very good wind

for me, as I intended to go out by the Bashee Passage. I therefore made sail under close-reefed top-sails and courses, steering East about six miles per hour till noon, when we observed, in latitude 21° 7′ N., and estimated longitude 113° 20′ E., a very heavy sea running, but the brig going along nobly. About 1 P. M. a tremendous gust of wind came on from the S. W., which laid the brig on her beam ends; I fortunately got the fore-top-sail, fore-sail and main-sail in before it struck us, but the main-top-sail was shivered to pieces; it then blew a perfect tyfoon, with a sea which I cannot describe striking us in all quarters; the bulwarks were very soon washed away on both sides, and a number of articles washed off the decks; some of the tremendous seas striking us under the counter and abaft, I began to be afraid that if it continued long, some of these seas would stave the counter in, or start some of the butt-ends abaft. Still the good old brig, although lying half the deck in the water, and the awful seas breaking over her, made very little water indeed. The Barometer was now 28.50. About 6 P. M. still blowing I may say a hurricane, and the sea in pyramids about us, I found the brig making more water, but nothing to be alarmed at. At midnight the same kind of weather, and found she was making more water. Immediately set to both pumps, and continued till 4 A. M., the brig gaining on us fast. At 4 A. M., found there was four feet water in the hold; immediately made what possible sail we could, for the purpose of running back to Macao or in with the Coast, as I expected we could not be far from it, supposing, from the sudden leak that the brig must be stove or have started a butt. I got the fore-top-sail on her and fore-sail, steering N. E., when she had gone about five miles, both pumps going, she came up in the wind against the helm, fell over her side, and filled with water immediately; we had hardly time to save ourselves by laying hold of the main rigging. Mr. Hays, the Chief Officer, and some of the men, were cutting the lashing of the long boat and of the other boats at the time; most providentially for him he got hold, but one poor fellow missed his, and we never saw him more. About 6 A. M., it cleared up a little, and we saw the land bearing W. N. W. of us, found that the wreck was driving fast towards the shore, all the people in the main rigging and chains, the sea making a clear breach over us; we all stripped of our clothing to a shirt or frock, in case we might be washed away, so as to be lighter in swimming, and there we hung in a most miserable state from 6 to about 11 A. M., when we were driven into the surf by the sea and current. Having the fore-top-sail set, and fore-sail hanging down, it assisted us greatly in getting sooner in shore, and most miraculously and providentially, we were driven into a very small sandy Bay, on each side of which were tremendous precipices of rocks, where if we had gone, all hands would have been dashed to pieces, and none left to tell the tale; but the mercy of God is great, and I am truly thankful for the saving of our lives. When we got into the surf, it was running so very high, and carrying every thing before it, that those of the people who could swim well, got hold of some boxes and spars, and took to the water for their lives. The brig very soon went all to pieces in the tremendous surf, and every body was washed hither and thither; most fortunately they all got on shore safe, but bruised." After being plundered and suffering much, the Captain and Crew reached Canton.

Captain Biden adds to this Log, the following Remarks

I was at Macao during the hurricane in which the *Bee* was wrecked, it raged with great violence accompanied with incessant rain, the sea broke over the Praya Grande, and doors and windows on the ground floor of the houses on the Praya Grande were in many instances burst open with the violence of the wind and sea together. The shipping in the Cum-sing-moon and Cap-sing-moon rode out the tremendous gale with yards and topmasts struck and with two anchors a-head. Several ships at Whampoa Reach dragged their anchors, and although the Chinese were as usual well prepared, by hauling their boats into every islet and creek between Macao and Canton, much loss and damage was sustained on the river.

We will now consider the track, which I have assigned to this storm. The data for it are complicated by two circumstances, the first that we do not know, with the *Virginia*, when the S. Westerly monsoon replaced the S. Westerly gale, (which she found as of course on the S. E. quadrant of the storm,) and with the *Bee* that a storm coming, as this undoubtedly did from the S. Eastward, and impinging upon the high South Coast of China at so direct an angle as it must have done, must have been subject, at short distances from the Coast, (and the *Bee* was only 42 miles from the nearest point at noon on the 9th,) to great irregularities; of which we have abundant instances.

At noon on the 27th, the *Virginia* was just on the S. E. edge of the Macclesfield Shoal, and the "bank of heavy clouds in the E. S. E. was, I have no doubt, the outer barrier of the storm, travelling up from the S. E. between her and the Coast of Luconia.* To noon the next day, 28th, she made a course of 75 miles to the N. Eastward, and thus neared the track of the storm, but as the wind held to the N. N. W., she could only, fortunately for her, make this distance; but we find that the gale was veering rapidly with her, or 6 points in 7 hours, while she was hove to; or from noon on the 28th till 9 P. M. when the wind was so far to the South, that she could scud; a proof, that it was travelling up with great rapidity, and probably passing near her position. It had, moreover, I am inclined to think, not arrived at its full violence at that time. We find that as it ought to do, it began with the *Bee* from the N. Eastward when just outside, and that it veered to S. W., when she was laid on her beam ends. There is the anomaly of the wind being *South first*, and then becoming N. W. but as I have said we cannot account for these anomalies when so near the land.† Upon the whole then, I think we shall not be far wrong if we assign, as tolerably ascertained, a course from S. 40° E. to the N. 40° W. for this storm.

We should not forget that it is *possible* there may have been two storms, one from the E. N. E. and another from the S. E., which may have united near the *Bee's* position, and have caused the temporary moderating and Southerly wind which tempted her to make sail, the burst from the S. W. being the combined effect of both; but for this assumption, we have no sort of authority.

TRACK No. XXII.

LOWTHER CASTLE'S *Storm.*

Memorandum of the LOWTHER CASTLE'S *Storm from the India House.*

12th October, 1833.—H. C. S. *Lowther Castle* proceeding up the China sea. Latitude 16° 30′ N., longitude 117° 53′ E. Noon, Barometer 29.72, Thermometer 83°.

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* See Col. Reid and various logs in my memoirs for instances of these banks of clouds.

† I have omitted to notice another source of uncertainty as to the *Bee's* position before noon of the 29th. I mean the heavy current to the Westward, which we know prevails at times on the South Coast of China in these storms.

Experienced a very severe gale commencing at N. W., and veering round to the E., and then abating in violence. It blew so hard while it lasted, that it brought us under a close reefed storm mizen try-sail, being compelled to take in the storm main and mizen stay-sail. The Barometer fell during the gale to 29.42 at 8. P.M. Shortly after which the gale moderated, and the Barometer gradually rose to 29.69. At noon on the 13th October, Thermometer 84°.

The *Lowther Castle's* storm, though apparently of small extent and of short duration, is a very remarkable one, both for the fall of the Barometer and the peculiar veering of the wind from N. W. to East, which, with allowance for drift, will give a track of about from N. 12° E. to the S. 12° W., which is much nearer the meridian than any we have yet found coming from the N. E. The memorandum is scanty enough, but I have thought it proper, on account of its probably peculiar nature, to mark a conjectural track for it, as serving to warn the seaman at this season of the year, that such small storms *may* arise. It seems certain enough, that we have rotatory storms of all sizes, and the only question in my mind is, *If the very small ones obey the same laws as the large ones, at sea and on shore?* or if not, where the difference begins? what is the law for the smaller ones? and what the cause of the difference? These questions I propose to investigate on a future day, and to do more than to advert to them here, would be somewhat foreign to our present subject.*

1835.

TRACK No. XXIII.

The TROUGHTON'S *Tyfoon, July* 1835.

Two severe Tyfoons occurred in the China seas in this year, during the height of the N. W. Monsoon, being those of the *Troughton* and the well-known one of the *Raleigh;* as the first occurring, I give that of the *Troughton.*

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* As an analogous instance of a small storm of great violence, but in travelling about *from* SbE. to NbW. see Second Memoir on the Law of Storms, Jour. As. Soc., 840, vol. ix. The Cashmere Merchant's Storm.

The *Chinese Repository* for July 1835, Vol. V. p. 151, gives the following account of this storm, in which this unfortunate vessel was disabled, being afterwards plundered by the Chinese fishermen and Ladrones:—

"*8th July,* 1835.—The English bark *Troughton,* Captain James "Thompson, from London, and last from Singapore, arrived this day "in distress. It appears that on the 3d July, in latitude 20° 21′ N., "longitude 112° 53′ E., she experienced a very heavy gale from the N. "E., which was succeeded by a more violent wind from the S. W. The "wind blew to pieces the double reefed main top-sail, and from the "labouring of the ship in the cross sea the main mast gave way, carrying with it the fore and mizen masts, the waves breaking completely "over the deck. During the three following days, the crew were "worn out by pumping, and working at the rigging of the jury "masts. By this time she was near the Mandarin's Cap, when "she was plundered." Details of this and of the sufferings of the crew are given at length, but these do not belong to our subject.

This unfortunately meagre record (for our purpose) allows us to do no more than to assign a conjectural track for this tyfoon, for from the changes of the wind it evidently was one. I have, therefore, with allowance for her drift, given it one conjecturally from the S.E.bS. to the N.W.bN., as it would clearly have been one from S. E. to N. W. had the vessel remained stationary while the N. E. storm lasted; and I have made the line of track to pass 60 miles to the S. W. of the latitude and longitude given on the 3d, as the ship must have drifted to, at least, that distance to the S. W. into the path of the storm, so as to have had the centre passing over her.

TRACK No. XXIV.

The RALEIGH'S *Tyfoon, August* 1835.

I was at first inclined to omit the details of this storm as appearing almost a useless repetition, but my object being to collect here *all* the details of *all* the storms in the China seas of which any record exists, it would have been imperfectly fulfilled, had I not inserted the results of the valuable labours of Mr. Redfield and Col. Reid, relative to this remarkable storm. The following, then, is copied from Mr. Redfield's Pamphlet, and I need not say, that the track is that laid down by him :—

The facts which have been chiefly relied on for establishing a South-western course for this gale, are contained in the report of H. M. S. RALEIGH, which was overset and disabled in this gale, in the China sea, when under bare poles, which report I have as follows :—

" H. M. Brig *Raleigh*, August 1, 1835.—Working out of Macao Roads at noon S. E., end of Formosa N. 85° E., 340 miles. Fine weather all day. August 3d at noon, S. end of Formosa N. 82½° E., 252 miles. Fine weather all day. August 4th, 10h. 20m. A. M. close reefed top-sails and courses, 12h. 30m. P. M. barometer fell from noon 15.100: took in main-sail and fore-sail—at 9h. 30m. got all snug, vessel going through the water between three and four knots ; barometer 29.40, falling ; at 7h. 30m. wind veered to N. N. E. and tyfoon commenced ; at 8 P. M. barometer 29.36 falling ; 8h. 30m. tyfoon increasing ; 10 P. M. close reefed fore try-sail and set it, tyfoon veered to N. E. with a heavy sea ; at midnight tyfoon increasing ; barometer 29.04, falling.

" August 5th, 3 A. M. tyfoon veered round to E. S. E. still increasing in violence ; 6H. 30M. barometer 28.25 ; 8 A. M. tyfoon increasing ; 9h. 30m. A. M. if possible blowing heavier, ship went over ; in this awful situation ship lay for about 20 minutes ; 9h. 50m. lower masts went by the board and ship righted with seven feet water in her hold ; barometer did not fall lower ; at noon tyfoon moderated a little ; at 6 P. M. tyfoon more moderate, with a heavy sea ; midnight, strong gusts of wind with heavy sea from South."—*Abridged from Canton Register of March* 14, 1837.

See also the log of the *Raleigh*, as it appears in Col. Reid's work, which contains a sketch, shewing the position of the *Raleigh* as given in the log, and illustrating the direction of the wind. Col. Reid has also given the position of a schooner, which encountered the tyfoon in latitude 18° 2′ N., longitude 15° 50′ E., of which I had previously received no account. I will now submit such evidence as I possess, in addition to the account furnished by the *Raleigh* ; adding also a sketch and figure, illustrating the course and progress of the tyfoon, and which was prepared and stereotyped some months since in reference to furnishing an account of this hurricane.

At Macao, where the tyfoon was experienced on the 5th and 6th, many houses were greatly damaged ; also many lives were lost in the inner harbour, and some vessels driven on shore. The direction and changes of the wind at Macao are not stated ; but we are favored with the following valuable table of the state of the barometer during the period of the storm :—

H.	M.		Barometer.
5th August.			
1	0	A. M.	29.47
2	30	P. M.	29.28
5	0	,,	29.20
7	20	,,	29.12
9	0	,,	29.08
10	20	,,	28.95
10	45	,,	28.90
11	5	,,	28.85
11	30	,,	28.75
11	53	,,	28.65
6th August.			
0	15	A. M.	28.50
0	30	..	28.40
0	45	A. M.	28.30
1	20	,, (lowest)	28.05
1	25	,,	28.08
1	45	,,	28.20
1	55	,,	28.30
2	0	,,	28.37
2	25	,,	28.56
2	45	,,	28.68
3	10	,,	28.75
3	40	,,	28.83
4	10	,,	28.90
4	45	,,	28.97
5	10	,,	29.02
6	0	,,	29.08
6	45	A. M.	29.12
7	45	,,	29.20
8	15	,,	29.21
8	45	,,	29.23
9	30	,,	29.27
10	25	,,	29.30
11	0	,,	29.34
2	0	,,	29.42

and continued rising to 29.65, at which point it usually stands during fine weather."—*Canton Register, August* 15.

This table affords in itself good evidence of the passage of the centre of the vortex near to Macao.

At Canton (60 miles North of Macao,) the tyfoon began on the evening of the 5th, after three or four days of very hot weather, with Northerly winds, and continued throughout the night and the next day. Its violence was greatest about 2 o'clock on the morning of the 6th. The following is an account of the state of the Barometer and Winds at Canton.

This relates to "fine weather" of the S. W. monsoon; the mean of the Barometer for July and August being at Canton 0.40 inch lower than for December and January in the N. E. monsoon. This Barometer at Macao appears to stand about 0.15 or 0.20 inch lower in its adjustment than that used at Canton for the reports in the Canton Register, the mean of which for five years is 30.027. Many if not most of the common ship Barometers stand too low in their adjustment.

		4th August.		
9	A. M.	Barometer	29.79	N. W. fine weather.
4	P. M.	,,	20.70	N. by W. moderate breeze.
		5th August.		
9	A. M.	,,	29.62	Wind N. and N. W., fair weather.
4	P. M.	,,	29.54	,, unsettled rain and fresh breeze.
12	P. M.	,,	29.37	,, N. blowing hard and in heavy gusts.
		6th August.		
5	A. M.	,,	29.34	Wind N. E. blowing hard with heavy rain.
9	A. M.	,,	29.51	,, S. E. ,, ,,
11	A. M.	,,	29.58	,, blowing hard, moderating.
5	P. M.	,,	29.70	,, S. E. ,,
11	P. M.	,,	29.85	,, S. E. ,,

7th August.

8 A.M. *Barometer* 29.94. *Wind S.E. cloudy. Compiled from the Canton Register.*

On Wednesday the 5th instant, a tyfoon swept over the city of Canton. It began in the evening and continued throughout the night and the next day, blowing its best about 2 o'clock in the morning. The damage done by the tyfoon at Canton is small, but not so at Kumsingmoon, Macao, and elsewhere on the coast.—*Canton Paper.*

The American ship *Levant*, Captain Dumaresq, which arrived on the 7th of August, the day after the gale, came in with royals set, from Gasper Island, in fourteen days, having had light winds all the way up the China sea, and *did not feel the tyfoon.* This important fact is stated in the *Canton Register* of *August* 11.

Extract from a private letter from on board the ship *Lady Hayes*, which left Macao roads a day or two before the storm, and returned to Kumsingmoon after the gale.

" Early in the morning of the 5th, we observed indications of bad weather. At 10 A. M. the wind freshened a little from the same quarter, it had been for the last twenty-four hours, viz. North, so we thought it best to turn her head back again to look for shelter, fancying ourselves to be about thirty-five miles off the land. We carried a press of sail until noon, when we found we had too great a distance to run before we could get into shelter, and expecting it would get so thick that we could not see our way ; so we turned her head to sea, and clapped on as much sail as she could stagger under, *steering S. E. by E.* The wind being then at North, we were desirous of getting as far off the land as possible, expecting the wind round to the Eastward, there being a most *tremendous swell* from that quarter. *At* 4 P. M. it was blowing in severe gusts, and shipping a good deal of water, and the ship becoming unmanageable. About 8h. 30m. *the wind began to veer to the west*, but continued to blow as hard as ever, till midnight, when it *drew round to South*, and moderated a little. It continued to blow hard from that quarter until noon of the 6th, when it moderated fast, and we began bending other sails in room of those that were split. When the gale commenced, which we consider it did *at* 1 P. M. *on the 5th*, we were about twenty miles East of the Lema; where we were when it ended, it is hard to say as we saw nothing till the morning of the 7th, when we made Mondego Island. We hardly think we could have had the gale so heavy as those inside, and what is most extraordinary, the wind with them veered to the *Eastward round to South* ; but with us it veered to the Westward ; for had it veered to Eastward, we should most likely have been driven on shore among the Islands, as we could not have been more than fifty miles off the land (?) at 8 P. M. on the 6th.—*Abridged from the Canton Register of August* 18.

On the reduced chart, which is given herewith, the tracks of the *Lady Hayes* and the *Levant* are laid down by estimate from the printed accounts.

The small dotted circle B., surrounded by the storm arrows, is supposed to indicate the position of the centre of the storm at the time the *Raleigh* was overset; and the position of the latter should be marked somewhat nearer this circle, according to the latitude and longitude of the *Raleigh* on the 5th, which Col. Reid has given in her long. The course of the storm appears to have been N. 72° W., and its centre is supposed to have been opposite the *Raleigh*, about 8h. 20m. A. M. on the 5th; but this cannot be ascertained with precision, as the indications of the Barometer do not appear to have been closely watched and recorded during this terrific period of the storm.

Having shewn the rotatory character of these tempests, I consider the depression of the Barometer which attends them, as being due to the rotative action; and the point of greatest depression as indicating the true centre or axis of the storm. From the evidence now before us, we arrive at the following facts :—

1. That the *Raleigh* met a gale which set in with the wind at N., *veering round by the E. to E. S. and South.*

2. That at the harbours and roads "inside," (Macao, Kum-sing-moon, &c.) as well as at Canton, the gale occurred *at a later period;* and the wind *also set in at North, and veered to E. and S. E.*, in a manner similar to that reported by the *Raleigh.*

3. That with the ship *Lady Hayes*, off the islands near Macao, the wind also set in at North; but the ship steering S. E. by E. under a press of sail (and doubtless falling off with the heavy sea from Eastward) and wind, towards the middle of the gale, began to *veer towards the West, whence it drew round to South* towards the close of the gale.

4. That the violence of the wind was apparently greater with the *Raleigh*, than with the *Lady Hayes.*

5. That the gale was experienced by an English Schooner, August 5th, in latitude 18° 2′ N., longitude, 15° 50′ E. ; but the *Levant* arriving on the 7th in her course through the China sea, *did not encounter the gale.*

6. That the fall and rise of the Barometer at Macao and with the *Raleigh*, and the strength and changes of wind with the latter, were such as are often exhibited near the centre of a hurricane; and that the minimum depression of the Barometer occurred about *seventeen hours later at Macao* than with the *Raleigh.*

These facts seem to establish the following conclusions :—

1. That the tyfoon advanced *in a Westerly direction.*

2. Negatively—that it did *not* pass through the China sea, from N. E. to S. W., nor on the opposite of this course.

3. That it was a *progressive whirlwind storm*, turning to the left, round its axis of rotation.

4. That its centre of rotation passed to the *Northward* of the *Lady Hayes*, and to the *Southward* of the *Raleigh* and of Canton, and the an-

chorages near Macao; and nearly on the line A. B. C. as marked on our chart.

5. That the rate of its progress was about *seventeen nautical miles per hour.*

6. That the extent or diameter of the violent part of the gale, as deduced from its duration and rate of progress, was about four hundred nautical miles, or equal to six or seven degrees of latitude.

7. That the latter induction agrees with the geographical evidence, which has been obtained of the visitation of the storm.

The progress of the tyfoon being taken at 17 miles per hour, it follows that the excess of velocity of the wind at E. with the *Raleigh,* over that of the wind at W. with the *Lady Hayes,* supposing the rotation to have been in a circle, would be more than thirty miles an hour; allowing nothing, however, for difference of retardation of the surface wind, and not taking into the account the additional retardation which the West wind of the *Lady Hayes* must have been subject to, in its recurving course over the land. If a circle be drawn on the chart around each of the points B. and C., with a radius equal to 3 or 3½ degrees of latitude, these circles will comprise, somewhat nearly, the field of action of the storm at the two periods of 9 A. M. of the 5th, and 2 A. M. on the 6th of August.

The progressive velocity and course of this tyfoon is nearly the same as that of the Trinidad hurricane of June, 1831; and the rate of progression also corresponds nearly to that of the Antigua hurricane of August 12th, 1835. See Tracks Nos. I. and V. on my chart of the courses of hurricanes in the April No. of the *Nautical Magazine,* 1836.

This examination of the case before us, appears to shew, that the direction of rotation, and the course of progression of this tyfoon, which crossing the China sea, agrees with those of the hurricanes of the West Indies; and that its course was not controlled, or materially influenced, by the existing South-west monsoon."

1836.

I have only the following notices of a storm in this year, from the *Chinese Repository* :—

About 29th* July and 1st August, 1836, a severe gale was experienced on the South Coast of China, which was very destructive to the shipping in the China seas. The bark *Susanna* of Macao, and the *Admiral Buyskes,* a Spanish ship, were lost with a part of their crews. Apprehensions were felt for two or three other ships, the *Hormasjee Bomanjee, Hamoody,* and *Margaret Graham.*

The *Repository* of September says, in reference to this: The *Hormasjee Bomanjee, Hamoody,* and *Margaret Graham,* are given up as lost. On the 31st July, at 10 A. M., the *Alexander*, Captain Wilson, from Macao to Singapore, was wrecked in latitude 10° 28', longitude 111° 27' E. No lives lost, but no property saved. The *Hamoody* is said to have reached Manilla.*

TRACK No. XXV.

Tyfoons of the ARIEL *and* VANSITTART, *16th to 22d Nov.* 1837.

I have been favoured by Capt. Burt, with the Log of the ARIEL, *of which the following is an abstract reduced to civil time.*

15th November, 1837.—The Barque *Ariel*, bound to China, was at noon in latitude 15° 1' N., longitude per chronometer 116° 15' E. with fresh gales from N. N. E., hazy weather and heavy sea on; having increased to this from a steady breeze at midnight of the 14th, vessel standing to the EbS. going 7 and 8 knots. P. M. wind marked N. E. and to 10 P. M. standing to the East; gale increasing rapidly to midnight. At 10, wore to the Northward.

16th November.—Wind N.E. to noon; heavy cross sea running very high. At 8, wore to the East, lost mizen-topmast. Noon hard gales N., mountainous sea, latitude observation 15° 8' N., longitude 116° 45'. Wind about N.N.E., P. M. wind N.N.E. to midnight.

17th November.—Gale still increasing and "every appearance of a dreadful tyfoon. Barometer still high at 30.10, and Sympiesometer as usual. Daylight wind hauled to the North in a tremendous squall; 10, blowing awfully hard, and sea beyond description. Noon tyfoon blowing dreadfully, wind N. W. and sea like pyramids all round, could not look to windward, for the wind, rain, and sea blowing on board; the ship frequently lurching half the main rigging, and oftentimes the bowsprit under water. Barometer fell to 29.80. P. M. wind West, a most dreadful tyfoon blowing, ship in a most perilous situation. At 2, wind N. W., and then for two hours till 4 P. M. I really cannot describe the scene; the ship rising with difficulty to several of the lurches got all ready to cut away the masts. At 4

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* These are too vague to mark any track from, but they may serve as memoranda. I shall be glad to receive the logs of any vessels which may have experienced this storm.

P. M., the ship lay over so much, that half the lower yards were in the water, saw that she was settling down and upon her beam ends, the water being up to her main hatch. Cut away the main-mast, which carried away the mizen-mast and fore-top-mast with it. Ship righted, three feet water in the hold, sea breaking over us in all quarters. At* —— P. M. the Barometer began to rise, and was at 29.90; and at 6 P. M. at 30.10; during the whole of the night it still blew tremendously, wind veering from N. W. to W. S. W. and South, with constant rain.

18*th November.*—At day-light still blowing hard, and an awful sea running. At 10, wind hauled to S. E., when it began to moderate. Noon, strong gales from the S. E. and sea running, but every appearance of the gale breaking up. Set storm-fore-staysail and hauled up to North, supposing we were well to the West of the Scarborough Shoal, in the neighbourhood of which we must have been all night.

" During this awful tyfoon, the Barometer gave no indication of its approach, for we were under bare poles a long time before it fell, it being all the time at 30.10, then it fell to 29.80, and again it rose to 30.10—15—25 to 35, still gale blowing as hard as ever, and at noon it was at 30.90." No observation. P. M. strong gales from S. E., hauling to East. At 3 P. M. gale again increasing with threatening appearance all round. 3h. 10m. saw the breakers on the Scarborough Shoal, one or two miles off, bearing N. W. by N. to E. N. E., sea breaking mountains high upon it; bore up to the W. S. W. to clear it. 6 P. M. severe gales from the N. N. E. with dreadful weather, sea washing over us in all quarters. At 10, hove to, vessel being very uneasy, and at times severely struck by the sea. Midnight very severe gales from the Northward, with continued rain and an awful sea.

19*th November.*—Day-light the same severe gales and dreadful weather with constant rain, and so thick, we could not see the length of the ship. Wind N. N. W. and tremendous sea. Noon moderating, and wind hauling to the N. N. E. From noon 18th, Barometer *rose* from 30.35 to 31.30. P. M. wind marked N. E. Strong gales, constant rain and awful sea, which we were shipping all over us. After consultation with the officers, bore up for Singapore at 3 P. M., running West till midnight.

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* Blank in MSS.

20th November.—Midnight gale increasing again, and heavy seas breaking fore and aft, hove to again till daylight, when severe gales from N. N. W., bore up and scudded under the storm staysail. Noon more moderate, but blowing hard with an awful sea. P. M. strong gales from N. E. with heavy rain, sea falling a little. Midnight more moderate.

21st November.—Noon fresh breezes from N. E. to midnight, with dark squally weather, but decreasing wind and sea.

22d November.—Decreasing to light breezes from E. N. E. and fine; a long, heavy, turbulent sea on. Noon, light Easterly winds and a heavy sea. Latitude 12° 38′ N., longitude 112° 5′ E.

Memorandum of the VANSITTART'S *Storms off the Coast of Luconia, 17th to 22d November* 1837, *by Capt. Macqueen, then commanding her.*

From the East India House.

"*17th November,* 1837.—In latitude 15° 55′ N., longitude 119° 30′ E., my ship, the *Vansittart,* encountered a severe gale of wind, commencing at sunset with tremendous gusts from the N. W. with lightning and rain. About midnight it blew a perfect hurricane, the wind gradually veering round to the S. W., which caused a very heavy sea. Next morning the weather moderated with the wind at S. E.; made sail, and at noon on the 18th, sighted Cape Bolinao. At 6 P. M. on the 19th, the gale recommenced with increased fury from the N. E. and continued with little intermission for the four following days."

I should observe here, that I have copied this memorandum literally, for reasons which will hereafter appear.

In considering the foregoing storms, I shall first commence with those of the *Ariel,* (for as I shall afterwards shew, they are different from those of the *Vansittart,*) and of course with that first in date.

The *Ariel's* position is fortunately well ascertained on the 16th by observation, and on the 18th by working back her run from 3h. 10m. P. M. when she sighted the Scarborough Shoal. Her drift made good, then, during this 48 hours is S. 75° E. 62 miles, which agrees as nearly as possible with what appears from careful projection to have been, up to this time, the track of the storm, *i. e.* about on a line S. 75° E. to N. 75° W. Another instance in addition to those before quoted of ships being sometimes drifted round the quadrant of a storm, so as to arrive, at the conclusion of it, at a point in the first storm circle, opposite to that at which it commenced with them. The *Ariel* appears also from the terrific violence of the wind, the pyramidal sea, and the rapid veering of the wind from North at day-light of the 17th to about South, at midnight of the same day, or 16 points in 18 hours, to have been drifting close past the centre.

From this time, however, it appears, that the storm must have curved away to the W.S.W. and S.W., so as to bring the ship upon its North Eastern quadrant, and the wind consequently to S.E., at which it remained from 10 A. M. on the 18th till 3 P. M., when the sight of the breakers on the Scarborough obliged them to bear up. By 6 P. M., they had again severe gales from the N.N.E., the wind having hauled round by the East. I consider that this was the beginning of a second storm, but that it was, as will be shewn in the log of the *Vansittart*, a storm occasioned by the N. E. monsoon setting in with the force of a gale, and not a rotatory one, for the ship though suffering very severe weather, had the winds constantly between N. N. W. and N. E. only, till they obtained fine weather, though running to the Westward. Had this second gale been a circular storm, it must have overtaken and passed them when hove to, when it would have veered either by the East or West, but this *vibrating* of the winds, as above, is like that of a strong monsoon gale, disturbed on its course by the *Vansittart's* and *Ariel's* storms, and we have I consider, no data whatsoever from which to consider it a circular storm; I have thus not marked it on the chart.

We now come to consider the *Vansittart's* storms. These it is evident could not be the same as the *Ariel's*, for the ships were at least 170 miles apart, the *Vansittart*, bearing N. E. by E. ½ E. from the *Ariel* at noon on the 16th, when this last had an awful tyfoon at

N. W. with its centre close to her; that of the *Vansittart* beginning only at sunset on the 17th—the memorandum which I have exactly copied evidently relating to civil time,* though it is not said so.

The *Vansittart's* second storm is, I think, also clearly a monsoon gale, as there is no account of its veering or changing. I have therefore marked her first storm, conjecturally only, parallel to our track No. V. as passing Cape Bolinao, and travelling to the W. S. W.

The singular phenomenon of the Barometer's giving no warning, remaining so high, and falling so little in such a terrific tempest, is most remarkable. Our first care is of course to ascertain, that it really occurred, before reasoning about it. I wrote to Captain Burt, who was then Chief Officer of the *Ariel,* requesting to know if there was any reason to mistrust the Barometer in any way? if they had compared it on arriving at Macao? &c. His answer is as follows:—

"We had no reason to mistrust the Barometer, as it had always indicated any change in the weather correctly. I am not aware whether Captain Warden compared it with any other in Singapore or not; he was then in command of the *Ariel.* It is not the same glass we have at present. It was on board the ship 18 months after the tyfoon, and we always found it true."

There seems then little doubt that the anomaly did really occur; the question then is, "To what can it be attributed?"

If, as I have shewn, we suppose the two storms approaching the same point, the *Vansittart's* from the N. E., and the *Ariel's* from the E.S.E., with a heavy N. E. monsoon behind the former, blowing through the whole extent of the trade wind across the Northern Pacific, and unchecked, except partially by the N.W. point of Luconia, we shall have three causes, all tending to augment the atmospheric column not far to the Westward of where the *Ariel* was on the 16th. I can see no other more simple or more probable explanation. It is however an anomaly to be carefully borne in mind by the seaman, and by all who investigate the *Law of Storms,* and the more so, that even the Sympiesometer also gave no indication of the approaching mischief.!

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* If we were to call it nautical time, "sunset of the 17th" would be sunset of the 16th civil time, but there is still a discrepancy wholly irreconcilable, for the *Ariel* had then had her tyfoon blowing for at least 6 or 9 hours from the N. N. E. The high land of Luzon cannot have occasioned all this anomaly.

1838.

For this year the only notice I have obtained of, apparently, a severe storm, is the following from the *Chinese Repository* of September 1838.

The bark *Claremont* having sprung a leak, foundered near the Ladrones on the 24th September. She encountered a gale on the 22d in lat. 19° 2′ N. and long. 114° 50′ E. As this gale is not noticed as having occurred in China, it was probably either of small extent if the *Claremont* suffered from its Southern quadrant, or one passing to the Southward of this latitude if she had the Northern quadrant of it. We cannot even conjecture its track from this notice, but as before observed, the date is always a record worth preserving.

1839.

The SUNDA'S *Storm.*

The British bark *Sunda*, by an account printed in the Canton press, saw on the 7th October, 1839, at 6 P. M. the land of Tyloo, N. E.bN. distant about 35 miles, weather very unsettled, and Barometer falling fast. All preparations for bad weather were made, and at 9 o'clock, the wind suddenly veered from N. N. W. to N. E.bE. and blew a strong gale, when many of the sails were blown from the yards. At 3 A. M. of the 8th, it blew a hurricane accompanied with a tremendous sea. At 8 A.M., it abated a little, but the sea more violent, and tossing in all directions; from this time the wind continued to abate, but it still blew a strong gale with a heavy sea till the 10th, when it became moderate, the wind from the N. E. Vessel very much disabled by the loss of her top-masts and sails. On the 11th, it was fine, at 4 A. M. saw the Taya Islands W. S. W., distant 8 miles, when she bore up and anchored under the lee of one of them, but in the evening it again came on to blow from the E. N. E., when the cable parted, and she was wrecked. The crew were kindly treated and sent to Canton by the Chinese authorities.

I am inclined to consider this storm as only a violent monsoon gale, for there seems to have been no veering of the wind which could authorise us to consider it a rotatory storm. We have many cases in which the monsoon does sometimes set in with a gale rising almost to the force of a hurricane, and the season was sufficiently advanced for an early monsoon to begin. In Mr. Redfield's table of the changes of the monsoons, compiled from the *Canton Register*, it appears that in 1831 the change took place between the 1st and 14th October, and in 1830, from the 5th to the 12th October. This valuable document comes down only I regret to say to 1835, and I have not been able to find any source from which to continue it, or at least to ascertain the setting in of the monsoon for this year.

TRACKS No. XXVI AND XXVII.

The THETIS *and* GOLCONDA'S *Tyfoons.*

In No. CXIX of the *Journal of the Asiatic Society*, I published as my Fourth Memoir on the Law of Storms, accompanied by a chart, a detailed investigation of these two storms, in one or both of which, (for she might very possibly have been caught at their junction,) the unfortunate *Golconda*, with the head-quarters of the 37th Madras Native Infantry, and 300 troops on board, appears to have foundered.

In this it is clearly shewn, from the logs of the Ships *Thetis of London* and *Thetis of Calcutta*, which were almost in company with the *Golconda*, that they fell in, about the Macclesfield Bank, with *two* storms, one of which travelled from the S. 78° E. to the N. 78° W. passing about 100 miles to the North of the Macclesfield, and the other travelled from S. 10° E. to about the North 10° W.* Of the three Ships, the one, the *Thetis of London*, to all appearance perfectly aware of his position, with an excellent Simpiesometer and Barometer on board, the first oscillating *for twenty-four hours* before the gale! hove to at the right time and place to avoid running across the track of the storm, and received no injury. The second, the *Thetis of Calcutta*, with less warning, having no Simpiesometer on board, and being tempted by a fair S. West wind, ran on till she was in great danger, and finally lost her mainmast, had three feet water in her hold and was in great danger of foundering from her pumps being crushed by the fall of the mast.

The third, the unfortunate *Golconda*, which was but a short distance ahead, was in all probability lost by running into the centre of one of the storms.

I subjoin as an epitome of the evidence upon which this conclusion is founded, the comparative table from the logs of the two *Thetis'*, and must refer those who are desirous of further details to the memoir itself, in which I have endeavoured scrupulously to discuss the evidence, so as to have no shadow of doubt that there *must* have been two storms, and that their tracks cannot have been far from where I have laid them down.

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* This and the Lowther Castle's Storm p. 679, are the first Storms I have met with, the track of which was so near the Meridian.

Tabular View of the Hurricane of 22nd to 24th September 1840, *in the China Sea, as experienced by the ships* THETIS OF LONDON *and* THETIS OF CALCUTTA.

Date.	Ships' Names.	Winds and Weather.	Lat. N.	Lon. E.	Bar.	Simp.	Ther.	REMARKS.
			° ′	° ′				
19th Sept. at Noon.	London Thetis,..	Light Southerly. hot and sultry weather	14 20	113 39	29.94	0	86¼°	
	Calcutta Thetis,	Light SW. airs and fine,	11 44	111 15	29.79	0	92°	
20th Sept. at Noon.	London Thetis,..	Calms and Light SE. airs, sultry, ...	14 53	114 9	29.90	0	87	
	Calcutta Thetis,	SW. and WSW. airs and fine,...............	12 40	111 57	29.79	0	89	At Midnight squally weather.
21st Sept. at Noon.	London Thetis,..	Light NW. winds, gloomy and close, ...	15 57	115 9	29.87	29.30	84	Noon rain, thunder and squally; wind NW. Simp, very unsteady during this 24 hours.
	Calcutta Thetis,	Light from WNW. till 7 P.M. at 7 breeze freshening from NNW. thick cloudy weather, ...	13 20	112 40	29.70	0	89	

Date.	Ships' Names.	Winds and Weather.	Lat. N.	Lon. E.	Bar.	Simp.	Ther.	Remarks.
			° '	° '				
22nd Sept. at Noon.	London Thetis, ...	NNW. Increasing breeze and sea,	16·20	115·30	29 64	29·12	85½	Threatening; sea rising; glass falling, and wind increasing; hove to.
	Calcutta Thetis, ...	W. by S. strong breezes, ..	14·55	114·55	29·56	0	86	Increasing with gloomy weather; running to the NE.
22nd Sept. at Midnight.	London Thetis, ...	WNW. violent gale, terrific squalls, ...	0	0	0	0	0	Bar. still falling.
	Calcutta Thetis, ...	SW. Increasing and incessant squalls; running to the NE. and NW. since noon, ...	0	0	0	0	0	Sea getting up from SW.
23rd Sept. at Noon.*	London Thetis, ...	SW. almost a hurricane,	16·40	116·15	29·20	28·73	0	No abatement.
	Calcutta Thetis, ...	SW. furious tyfoon, lying to, ...	15 50	115·13	28·80	0	0	High sea; lost mizen topmast.
23rd Sept. at Midnight.	London Thetis, ...	About South, moderating fast, ...	0	0	29·50	0	0	Bore up at 5 P. M. Sea higher than in the gale.
	Calcutta Thetis, ...	SW. Heavy tyfoon, squalls not so frequent, ..	0	0	0	0	0	Sea very cross.
24th Sept. at Noon.	London Thetis, ...	SSE. Moderate, ...	18·25	117·20	29 80	0	81½	Fine and squalls, wind SE. and moderate to Macao.
	Calcutta Thetis, ...	S. Gale breaking, ...	17·14	115·35	29·40	0	0	AM. Rolled away the main mast, &c.; at 8 PM., wind SSE.

* Golconda probably lost about this time.

1840.

The ONEIDA'S *Tyfoon.*

October 1840, *from the Singapore Free Press.*

The following notice of a tyfoon in the China seas was elicited by the public notice of the Indian Government, of October 1839, published at my solicitation, requesting information from all persons on the subject of storms. It is, unfortunately, the only account we have of this storm, and though a good one, wants so many of the data from which to lay down its track, that all we can do is to notice it as a heavy tyfoon from *about* East or E. S. E. in *about* latitude 18° 40′ to 19° North, and *about* on the meridian of the Paracels.

TO THE EDITOR OF THE SINGAPORE FREE PRESS.

Dear Sir,—Noticing in your paper a request on the part of the British Government for information relative to storms, it seems incumbent upon me, visiting this port to repair damages sustained in one, to make a few observations, which though they may not be sufficiently close to aid the cause of science much, may be of interest to the general reader, or seaman, to whom I shall more particularly address them. I sailed from Canton on the 13th of October, and lost sight of the land about 5 P. M. Through the night and the next day the wind was N. E. and steady, and the general aspect of the weather was that which we see on sounding, or when the atmosphere is lit up by the reflection from 'green water,' as termed. At 9 P. M. I noticed the mercury to have fallen 20 parts of an inch from its usual standard at Canton for October, but apprehended no change, as it is liable to fall on approaching a lower latitude, and the weather continued good, wind having hauled about N. N. E. At 11 P. M. the barometer was 29.70, with more wind and a small swell from the Northward. At 3 A. M. it had fallen more, and appearances were changing in the thin misty clouds that were hurrying over and as fast collecting again. At 4 A. M. the mercury stood 29.50; and to be on the safe side, I double-reefed the topsails, furled the main sail and jib, and sent the royal-yards down, expecting an 'Easterly Gale.' At 5 A. M. the barometer had fallen lower, and the gale coming on thick and fast, without any indications to windward of more settled weather, I was forced to expect a hurricane against my previous opinions, supported as they were by the season, and the absence of those earlier indications, save the swell, that are usually considered a prelude to these tempests. Supposing in that even, that the wind would haul to the West as it then had to the North, brought the ship to three points, or S. W. by W., put preventers upon the yards, determined to carry sail at every hazard, and run from the gale as the rotary theory would seem to intimate,—but there was more to be feared from the North Paracel Shoal, inside, or to the West of which, I suppose we were. The top-gallant-yards were coming down between this and 7 o'clock, when it was full late to reduce sail; and the mizen-top-sail being in and the others upon the cap, I knew no end more conducive to our safety, than to carry on and let them blow away, which they soon did in a yaw to windward, leaving the fore-top-mast-stay-sail to veer under, which brought us round in a lurch that put at rest all further exertion to secure anything to leeward, or do much elsewhere, for the air was full of foam and spray. At 10 o'clock I found the wind had shifted within the last 20 minutes to W. S. W. and blew much harder than before, carrying the ship well over, or as near on her beam-ends, as is generally understood by that term when applied to ships laying in violent tempest that have not entirely capsized. I had not seen the barometer since last noted, for the passage to it was lumbered up, and I was more intent upon the compass, and thinking of the shoal, to leeward; but the Mate, who succeeded better, said it was 28.36'. One of the lee cabin dead-lights at this time burst open, and I believe the ship might have been lost from that cause alone, had no one been present, or the hinges have gone; for that side was under water. At 11 o'clock the mercury was up, but it was doubtful when it had moderated. At 12 P. M. it certainly had, and at 2 P. M. we were looking about us again. (We found the jibboom and appendages carried away, and a whole suit of sails from 'top to bottom,' for those that were furled had blown from the gaskets, and those sent down could not be secured to leeward and were lost—other spars, bulwarks, &c. were gone.) At noon of the next day, after sailing through the night and forenoon 1½ to 2 knots West against the swell, I found we were twenty miles North of the *North Paracel Shoal*, and on its meridian, which shewed that the S. W. current I had expected, and which is usually provided against in this vicinity, did not exist, and gave cause for the smoothness of the water that favoured us during the gale. We found the ship strained and badly chafed about the upper works and rigging, and not in a fit condition to enter the Indian ocean. This ship is considered one of the best built of American vessels, and probably any other; it may therefore not be improbable that more serious accidents have happened to others less favoured, if any were within the range of its influence

Whatever opinion may be entertained about the generation and motions of winds—it is not a new thing that deep gulphs, narrow passages, high lands, and extensive shoals, exercise a great influence over them; and the spot in consideration may be indebted to its known propensity for gales to that cause alone, as also the gulph of Mexico and California on the opposite side, and other deep indentations of coast.

Yours, &c.

George Barrell,

Master of the American ship Oneida, lately from China.

Singapore, Nov. 2, 1840.

TRACK No. XXVIII.

Magicienne *and* St. Paul's *Tyfoon.*

The following are the only notices I have been able to procure of this remarkable storm :—

30th November, 1840.

Magicienne *and* St. Paul's *Storm.*

The *Ariel* left Macao roads on the 30th November, having had fine weather with N. E. breezes on the 29th. At noon 30th, latitude account 20° 46′ N., longitude 113°, fine 7 knot breeze N. E.

Loss of the French Frigate Magicienne.

During the week some indistinct rumours had reached this place (Singapore) regarding the loss of the *Magicienne,* which have received unfortunate confirmation by the arrival of the *Iberia* from Manilla;

and the following brief particulars have been handed us by a gentleman, who has derived them from an authentic source.

On the 27th Nov., which was just a month after her departure from this port for Manilla, the *Magicienne* encountered a very strong gale in the *Palawan Passage,* which by the 29th had increased to a tyfoon, in which she lost her masts, and received so much damage in her rudder that she became unmanageable, and about 2 A. M. on the same day, she was carried by a strong current on to the Bombay Shoal,* to the N. N. W. of *Palawan;* and in this state borne on by a terrible sea, was dashed on the reef, where she instantly went to pieces. The crew immediately betook themselves to the construction of rafts, to reach a safe shore; but fortunately on the third day, the whole ship's company were picked up by two English vessels, the *Mysore* and *Clifford,* and the French vessel *Favorite,* on board of whichthey were conveyed in safety to Manila, where they arrived on the 15th instant. The French Corvette *Danaide,* left Manila on the 3d instant, for the scene of this disaster, with the intention, as was supposed, of recovering every thing that could be saved from the wreck, and had not returned by the 26th.—*Singapore Free Press,* 31*st Dec.* 1840.

The American Ship ST. PAUL.

The following account of a severe gale, which the American ship *St. Paul* encountered in the China sea, on her way from Manilla to this port, where she arrived in the course of the week, has been handed us for publication:—

" The American ship *St. Paul,* G. Pevice, commander, sailed from Manilla on the 26th November, having fine weather and the wind at from E. to N. N. E. until the 29th, sea account; the wind then freshened into a strong gale at N. E. Latitude 12°' N. longitude 112° 23′ E. On the 30th at 4 P. M. brought the ship under close reefed top-sails until 6, when she came to the wind, having lost her sails. The sea and wind continued to increase, and at half-past 6 P. M. the sea was making a complete breach over her, washed away the quarter boat, and so strained the ship as to cause a leak under her starboard quarter. At 7 P. M. the top-masts went by the board, being blown away—ship lying with lee rail under water until 1 A. M.; wind blowing a hurricane from N. E. Both pumps at work, the men obliged to be lashed to keep them agoing. The weather moderated at 1 A. M. for a short time, when the wind shifted to the N. W. and blew with still greater fury, and from thence suddenly shifted to S. W. at 3 A. M., blowing a complete hurricane, heavier than at any time before. At 6 A. M. the wind hauled round to S., and then to S. S. E., and it began to moderate at 8 A. M. During the gale the barometer ranged as follows :—

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* Lat. 9° 26½ N. long. 116° 54′ E.

At noon of the 29th, (sea account,)	29.70
4 P. M. 30th	29.60
6 „	29.40
8 „	29.40
11 „	28.40
2 A. M.	28.30
3 „	28.20
Noon.	29.55

[*Singapore Free Press, Dec.* 24.

We may from these accounts deduce, I think fairly enough, that *La Magicienne* was dismasted in the N. W. quadrant of a storm of which the centre did not pass far from the Bombay Shoal. The frigate was probably drifted upon the shoal by a N. W. current occasioned by S. Westerly wind in the S. E. quadrant of the storm, or by a N. Westerly current, created by the S. E. wind in its N. Easterly quadrant, according as she was to the S. E. or the N. W. of the shoal. The last is the most probable, because the usual track lies within the shoal.

We may take the centre then, in the absence of better data, to have passed over the Bombay Shoal, and about noon on the 29th, and we find that at 3 A. M. on the 30th, civil time, it had passed the *St. Paul*, which ship might then be about in latitude 11° N., longitude 111° E.

This gives a track of N. 75° W. and S. 75° E., and a distance of 360 miles in the 15 hours, or 24 miles per hour. This rate of travelling is also higher than any we have yet obtained for either the China Seas or Bay of Bengal, but it is not an excessive one compared with those of the Western hemisphere, and if we admit the two ships to have experienced the same storm, which is quite as probable as that there were two of them, we cannot be very far wrong as to this part of our estimate.

Another remark to be made, and it is one of much importance, is, that throughout this long period of years, this is the only instance in which we find a storm in so low a latitude as that of 11° N. the *Castlereagh's* Track, No. IX, being in about 12° N. The curves of those of the *Ariel* and *Moffatt,* if their storms reached so far, are only conjectural here, and reach the Coast of Cochin China in 12°, while the *Castle Huntley's* storm, Track No. XII, and the Calcutta *Thetis'* cross the usual route in 13°. We may then, as this space is as much crossed as any other part of the sea, infer, that when storms do occur so low as the latitudes of 10° or 11° N., they are of extreme violence, and perhaps (at least in this instance) also, they travel with great rapidity.

1841.

TRACK No. XXIX.

Hong Kong Tyfoon of 21*st July,* 1841.

In this year we have three remarkable tyfoons. Two in July, of which the centre passed close to Hong Kong, where great damage was done to the fleet lying there, and one which seems to have raged in about lat. 14° 20′ in November. Of this last I grieve to say, our records are very imperfect, though I personally applied again and again to parties, who could have afforded me such as would have enabled me to lay down a certain track for the storm.

The HASHMY'S *Hurricane at Hong Kong, July* 1841.

21*st July,* 1841, *civil time.*

First part thick cloudy weather, with an increasing breeze from the N. W. and squally, glass falling; 4 A. M. hard gusts from Northward, made all snug, increasing with tremendous gusts, let go the sheet and veered to 60 fathoms on the bowers, a barque astern in the way. 11 A. M. the tyfoon at its height, Barometer 28.90, Symp. 28.65, wind veering to the Eastward. The spray and mist of the sea only allowing us to see the mast-heads of the ships nearest to us, and completely concealing the hulls. Tyfoon drawing to the South and moderating, (time not mentioned,) several vessels dismasted and on shore ; great mischief done at the town, *James Lang* and *Prince George* lost.

Tyfoon of 21*st July.*

The following Table is copied from the *Canton Register* That for the storm of the 26th, from the same source, I have given afterwards, to avoid confounding the documents relative to the two Storms :—

Wednesday the 21*st.*

8	0	A. M.	29.42	N. W.	showery and fresh.
9	30	,,	29.32	N. W.	Fresh wind.
10	0	,,	29.25	N.	Rainy.
11	0	,,	29.15	N.	Rainy and squally.
12	0	,,	29.03	N. E.	Strong wind.
1	0	P. M	28.96	N. E.	Gusts.
2	0	,,	28.92	E. N. E.	Hard gusts
3	0	,,	28.94	E.	
3	30	,,	29.04	E.	
4	0	,,	29.10	E.	Misty.
5	0	,,	29.21	S. E.	Rain and gusts.
6	0	,,	29.27	S.	Hard puffs.
7	0	,,	29.34	S.	Rain moderating.
8	0	,,	29.38	S.	Rain moderating.
9	0	,,	29.45	S.	Rain and high breeze.
10	0	,,	29.53	S.	Rain and high breeze.
11	0	,,	29.54	S.	Rain.
12	0	,,	26.54	S.	Fresh breeze.

The wind from the North in the first tyfoon was remarkable for its strength and duration. The effect upon vegetation in Macao was very destructive, every thing appearing as if it had been scorched ;

the air was filled with salt spray. Fortunately, the greater part of the rice crop in this vicinity had been harvested.

Captain Fraser, of the *Good Success*, in a letter dated 24th July, says, that on Thursday 22d, blowing strong from the S. S. E. they picked up a Portuguese, from whom they learned that he had belonged to the *Rose*, from the East Coast to Macao, which had foundered about three days before, at noon. *Grand Ladrone*, bearing N. ½ E. 29 miles, hove to and saved the crew of a junk. In the late severe weather we had not a tyfoon, being well to the Southward, but a heavy gale from S. W. with a tremendous sea.

The *Louisa* Cutter, bound to Hong Kong from Macao, left on 20th July, and at 10 P. M. the wind freshened till after midnight. On the 21st at daylight, it was blowing a gale from N. W. to N. N. W. By 3 P. M. the wind had veered to E. and S. E., and she was totally wrecked on the islands on the Western shore of the river. The Commodore and H. B. M. Commissioner, Mr. Elliott, who were passengers, narrowly escaped with their lives.

The ship *Ruby* on 15th July, 1841, was lying in Shih-poo harbour, on the East Coast of China, latitude 29° 2′ N., longitude 121° 40′ E. and had on that day at daylight Barometer falling. At 10, wind veering from N. E. to N. W. with heavy rain and a strong swell setting into the harbour. Made preparations for bad weather. Noon Barometer still falling, having sunk since the preceding evening from 29.80 to 29.20. P. M. weather finer, and at midnight quite fine and glass rising.

Abstract of the Log of the Brig KITTY, *Captain Willie, lying in Hong Kong Harbour, civil time.*

20*th July*, 1841.—Latterly light breezes, dark cloudy weather, and threatening appearance.

21*st July*.—Begins with the same. At 1h. 30m. strong gusts of wind from the Northward, with lightning in the West. Prepared for a tyfoon, wind N. N. Easterly, Barometer having fallen from 29.60 to 29.40. At 6h. 30m., heavy gusts from N. N. E. with rain, a tyfoon evidently approaching. Let go the best bower and veered to 90 fathoms. At 10 A. M., Barometer 29.10, blowing a furious hurricane from the

N. E. Let go sheet anchor, wind veering to the S. E. (time not noticed.) At 6 P. M. moderated to a gale from S. E., Barometer rising, and at midnight 29.40.

22d July.—From 1 to 6 gale moderate, but still in heavy gusts, at noon fine.

For this track I take the storm to have really veered from N. W. to S. E., as it did with the *Louisa* in the more open part of the river, and at Macao we find that the wind was at N. W., when the Barometer had already sunk to 29.32, which is far below the usual average at this season. At Hong Kong also it seems fairly enough to have begun at N. W., though in an enclosed anchorage with much high land to the N. E. of it, and beyond that on the continent of China, we must not look with any great nicety as to the exact point from which the wind may blow, particularly in the first part of a storm. A shift from N. W. to S. E. gives about a N. E. and S. W. track to the storm.

The bearing and distance of Shih-poo, where the *Ruby* was lying, from Macao, is about N. 40 or N. 42 E. 688 miles, and we see that a storm was probably passing from the N. E. to S. W., at 50 or 100 miles distance from her anchorage, at noon on the 15th. From noon 15th to noon 21st are six days, which time, if these storms were the same, it took to force its way over the high lands intervening between Shih-poo and Macao, which would give it 112 miles in 24 hours, or 4¾ miles per hour.

This is assuming it to have pursued a nearly straight course. If the mountain ranges forced it to take a curved track round the Coast, the rate of travelling would then be higher. We have, I think evidence enough, (see Third and Fifth Memoirs, *Journal of the Asiatic Society*, Vol. IX. p. 1049, and Vol. X. No. 121 1842, p. 20,) to shew that considerable retardation does occur, when storms meet with high land on their inland course, and thus there is no improbability in supposing the *Ruby's* Barometer to have been announcing to them the passage of the Macao storm.*

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* I mention here a practical result, to which I may advert in another Memoir. If China was a country under European dominion, a telegraph might, when these storms strike the Eastern Coast, warn those on the Southern, that they were coming, and in India we might often attain the same advantage. Our children may see this done.

TRACK No. XXX. *Hong Kong Tyfoon of the 26th July,* 1841.

Log of the Ship HASHMY, *lying at Hong Kong, 26th July* 1841, *civil time.*

2 A. M. Wind freshening from N. N. E. with sudden gusts, and threatening appearance, made all snug and veered away. 9 A. M. Tyfoon with fearful gusts, wind shifting rapidly to E. and S. E., furious gusts from S. E. with sudden lulls, time not marked. Barometer 28.40. Symp. 28.20. Glasses rising rapidly. In the evening, the wind moderated with heavy rain, wind S. W., possibly the Monsoon. It is a singular circumstance in this Tyfoon, and shewing the small extent of the vortex, that a ship at anchor in the Lantao Passage, had the tyfoon commencing at North, and shifting round to the Westward, while with us at Hong Kong, at about 15 miles to the Eastward, the wind shifted by way of East. The vortex must then have been very close to us, and its effects could not have been felt any distance from the land, as a ship came in from the Southward the following day with her royal yards across.

Extract from the Log of the Brig KITTY, *Capt. Willie, lying in Hong Kong Harbour, civil time.*

25th July, 1841.—Latter part dull cloudy weather, 6 h. 30 m. threatening appearance in the S. E., 7h. heavy gusts, at midnight calm and fresh breezes N. E. and North.

26th July.—Begins with fresh breezes from the Northward with lightning in the N. N. W. At 1h. sudden strong gusts of wind varying from N. N. E. to N. N. W. At 2h. 30m. A. M. a strong tyfoon from N., attended with furious gusts of wind and constant heavy rain. At 3, veered away and made all snug. 6 A. M. wind shifted to N. E. At 8 A. M., wind E. S. E. Barometer 28.605. 9 A. M. wind S. E. At 10, South, tyfoon still blowing furiously with constant heavy rain. Noon, wind varying from S. E. to S. Barometer 28.605. 3 P. M. more moderate, but heavy gusts at times. The same to midnight, gusts from S. and S. E.

27th July.—Moderating from midnight.

The following is the Barometrical Table at Macao, which, by the way, does not begin soon enough, for, if possible, the fall should always be watched from the usual average till it again returns to the same point. There are many very interesting questions connected with the more or less gradual or sudden falls and rises of those instruments, which observers can much contribute to solve by attending to this remark:—

Barometrical Register at Macao, Monday, the 26th July, 1841.

" 7	30	A. M.	29.17	N. W. Rain.
9	0	,,	28.94	N. W. Heavy rain.
10	0		28.94	W. High wind.
10	40		29.00	S. W. Rain and high wind.
11	0		29.08	S. W. Ditto.
0	25	P	29.25	S. W. Ditto.
1	0		29.33	S. S. W. Moderating.
2	0		29.37	S. Gusts.
3	0		29.40	S. Less wind.
4	0		29.44	S. Heavy rain.
5	0		29.49	S. Ditto.
6	0		29.53	S. Ditto from wind.
7	0		29.58	S. High breeze.
8	0		29.58	S. Rain.
9	0		29.64	S. Ditto.
10	0		29.68	S. Ditto.
11	0		29.70	S. Fresh breeze.
12	0		29.70	S. Ditto.

The above Table shews, that the wind on the 2d day veered from N. round to W. and S. W., but at Whampoa and Hong Kong, we have been told it veered from N. round to E. S. E. and S. W., this would indicate, according to the theory of Redfield, that the vortex passed between Macao and Hong Kong.

That the centre was *at one time* between Hong Kong and the Lantao Passage, there can be no doubt; as also, that this small tyfoon, for it appears to have been of limited extent, was one coming up from the S. E.bE., or about from the Grand Lema to the centre of Lantao

Island, its right hand quadrants, close to the centre, taking Hong Kong, while the left hand ones at different distances struck the ship in the Lantao Passage and the town of Macao. I have therefore given it that track, as one tolerably well ascertained for the only part of its course of which we have any notice, and marked it as No. XXX upon our chart.

ARDASEER'S *Tyfoon of November,* 1841.

For this tyfoon, I have only, I regret to say, the following Documents:—

Abridged Log of the Barque ARIEL, *Captain J. Burt, reduced to civil time.*

The *Ariel* left Macao roads at noon, 16th November, 1841, with moderate North breezes and fine weather. P. M. to midnight wind North to 3 P. M., and N. E.bN., afterwards stood to S. and S. S. W., 6 and 7 knots, with fresh breezes and cloudy at midnight.

17th November.—4 A. M. strong breeze and thick weather, noon fresh gale, (about N. N. E.), and thick weather with a cross sea, latitude account 19° 31′ N., longitude 111° 51′ E. P. M. strong breeze N. N. E. and thick rainy weather, 8 strong gales, increasing to severe gale at midnight when under bare poles.

18th November.—3 A. M. wind marked North. 2h. 30m. gale moderating. Day-light moderate, noon latitude observation 16° 09′ N., longitude 110° 09′ E. In the last two days a current of 70 miles to the S. W.bS.

MACAO, *29th July,* 1842.—The late arrivals report the occurrence of excessively heavy weather in the China Sea in the middle of November; the *Water Witch* encountered very hard gales for successive days, which nearly exhausted the crew; and the following extract of a letter from Capt. McIntyre, of the *Ardaseer,* will inform our readers of the narrow escape which that vessel had from foundering:—

'Left Singapore, Nov. 2, 1841; calm, anchored; noon on the 3d passed *Pedra Branca*; entered *Palawan Passage* on the 8th; wind shifted to the Eastward, determined to try the China Sea; passed *Pulo Supato* on the 11th with a S. W. gale; 13th, wind shifted to the

Northward; prepared for a gale; 14th and 15th, fine Northerly winds and clear weather. At midnight on the 16th, being then in latitude 14° 30′, longitude 114° 40′, the Barometer fell from 30 to 29. Sent down top-gallant yards, close-reefed and furled the top-sails, reefed and furled the main-sail. At 3 A. M., blowing a hurricane from the Northward; furled the fore-sail; spanker blown away; sea making a breach over all; 8 A. M., clouds rolling on, and the wind like the noise of thunder, sea confused and running mountains high; hove the ship to under bare poles; 9 A. M. thrown on our beam-ends, ship settling fast; and put the helm up, which she refused; little after 9, cut away the masts, and ship righted, sea at the time nearly swallowing us up; but the ship did not make an inch of water. Now under jury masts, and hope to make Manilla, as wind has been from the Westward for three days. Cabin filled with water; letters, chronometers, sextants, &c., all destroyed; cargo all right.' Ardaseer, at Sea, latitude 14° 50′, longitude 117° 15′.

SINGAPORE, 10*th December.*

Another Tyfoon.—On Tuesday afternoon the Clipper *Ardaseer*, which left this port for China on the 2d ult. returned into the roads under jury-masts, having on the 16th November experienced a severe tyfoon in the China seas, in latitude 14° 36′ North and longitude 14° 40′ East; during which she was compelled, as a last resort, to cut away all her masts. At 2 in the morning, the Barometer gave indications of the approaching tempest by falling from 30 to 29 inches, when thus forewarned, the hatches were battened down and every preparation made to meet the gale. In a few hours more, it was blowing a perfect hurricane, with the sea rising in pyramids in every direction, and making a clean breach over the vessel; which was now nearly on her beam ends, with both of her quarter boats carried away. They now attempted to heave over the guns, but could only succeed in getting one of them overboard, while they had to beat out the lee port to give a passage to the heavy body of water on the decks, tried to put the vessel before the wind, but she refused to answer her helm. At about half past 8 A. M., an awful gust accompanied by a tremendous sea threw the ship on her beam ends, the sea coming up to the coats of the masts, and the lee bulwarks, and part of the forecastle being under water. The dead lights were beaten in, partly by the violence of the sea, so that the deck and cabins were covered with water, and she seemed to be going bodily down. With the utmost difficulty, owing to the fury of the blast, and the frightful sea that was breaking over her, the masts were at last cut away, and it appeared that nothing but their fortunately all going nearly at the same time could in so critical a moment have saved the vessel. Being now clear of her masts she gradually righted, and fortunately for all on board, kept quite tight during the strength of the gale. Captain McIntyre having rigged jury-masts, now endeavoured to make Manilla as the nearest port, continuing in that direction until the 23d November, when finding it impracticable to make head against the monsoon in the state to which the ship's rigging had been reduced, he bore up for this port.—*Free Press, Dec.* 9.

It appears from these documents that the *Ariel* was bringing with her a heavy monsoon gale, or it may have been ran into the outskirts of the *Ardaseer's* tyfoon, since her position at noon on the 17th was about 330 miles N. E.b.N. of that of the *Ardaseer on the* 16*th*, and in the 24 hours, the storm might have easily travelled a great part of this distance, though it seems to have been spent, or that the *Ariel.* ran so rapidly to the South, making 2½ degrees of Southing, between the 17th and 18th, that she escaped it altogether. I am, however, more inclined to think, it was not the storm which she felt, for she would in that case have had the wind more Easterly of North if it passed to the South, and more Westerly of North if it passed to the North of her. Could we have obtained any intermediate logs, we might perhaps have found here some evidence of one of these storms, confounding itself with the regular monsoon.

With respect to the track of the *Ardaseer's* tyfoon, we cannot even make a conjectural one from these accounts. All that we can be sure of, is, that its centre must have been very near to her when she had drifted into, say latitude 14° 20′ or 14° 10′, which in this longitude is not far from our Track No. XI., but here our present knowledge of this storm, which was experienced by at least three, if not four, vessels belonging to the port of Calcutta, ceases.

The iron steamer *Medusa* on the 13th and 14th November, encountered a severe gale from the N. E. off the Grand Ladrone, which drove her down to Hainan North Bay, but this does not appear to have been any thing more than a monsoon gale. Her consort, the *Ariadne*, was compelled to bear up when near Manilla for want of fuel, and I believe experienced some bad weather, but her log has not reached me. The following is also a notice of a storm from the Singapore Free Press.

SINGAPORE.

On the evening of Sunday last, the signal was hoisted for a Steamer to the Eastward, and from the direction indicated, and the accounts that had been previously received of them, it was supposed to be one of the iron Steamers, either the *Ariadne* or *Medusa*, that started from this together for China on the 22d of last October.[1] This conjecture proved correct, the steamer turning out to be the *Medusa*, Captain Hewett, which had been compelled to put back to this port from want of fuel; and the following are the particulars that have been communicated to us of the voyage. On the 2d November, when about 120 miles from Manilla, the *Ariadne* signalised that they had burnt out all their fuel, upon which Captain Hewett, who was the senior officer, hung out the signal for her to return to Singapore; and his own vessel having still sufficient fuel to carry him on to Manilla, he continued his course for that port, which he reached on the 3d Nov., but with scarce an ounce of fuel remaining. Having taken in here about 30 tons of wretched coal, and as much wood as she could stow away, even to filling the cabins with it, the *Medusa* got under steam again on the 9th, and on the 13th, was off the *Great Ladrone*, when they encountered a gale from the North East, and having again burnt out all their fuel, they were compelled to bear away on the following day. Here their compasses shifted two points to the Westward, and at daylight they found themselves in Hainan North Bay, in the midst of breakers and seas running mountains high; to escape from this dangerous situation they had recourse to breaking up the ship's bulwarks and every piece of available timber on board, and thus provided a sufficiency of fuel for two hours steaming, by which they escaped the perils that surrounded them, after they had nearly given up all hopes. For five days they had no observation, but managed to run down into *Camaraigne Bay*, where they procured wood and water, but the former too green to burn. In a day or two afterwards they got amplitudes, and were enabled to rectify the error in the compasses, when they prosecuted the remainder of their voyage here in safety.

Captain Hewett of course expected to find that his consort had reached this port long before his own vessel—but she having neither arrived here, nor been otherwise heard of, apprehensions begin to be entertained of her ultimate safety.

The *Medusa* is now under orders to proceed to Maulmain, for which she will set out in the course of a few days.—*Ibid.*

The foregoing are all the records which I have hitherto obtained. I now proceed to offer a few deductions, practical and speculative, from them; the practical ones not as rules, but rather as hints for forming a judgment, and both as suggestions for those who may desire to aid in future researches in this important branch of science.

I commence with a tabular view of the tracks laid down in the Chart.

Tabular View of the Storm Tracks, laid down in the Chart.

No. of Track.	Dates.	Names.	Track of Storm.	Remarks.
I	1780 17th July,	H. C. S. London,	From N. 68 E. to S. 68 W.	Tyfoon.
II	1797 19th June,	H. C. S. Buccleugh,	——East to West,	Tyfoon.
III	1803 20th 23d Sept.	H. C. S. Coutts, Camden, &c.	——S.S.E. and E. to W.	Tyfoon, curved track, rate about 7 miles per hour.
IV	1803 20th 23d Sept.	H.C.S. Royal Geo. Warley, &c.	——N. 77 E. to S. 77 W.	Tyfoon, about 7 miles per hour.
V	1809 28th 29th Sept.	H. C. S. True Briton & Fleet,	——N. 60 E. to S. 60 W.	Tyfoon. True Briton foundered.
VI	1810 29th 30th Sept.	H. C. S. Elphinstone & Fleet,	——N. 78 E. to S. 78 W.	Tyfoon.
VII	1812 8th & 9th Sept.	H. M. S. Theban and Fleet,	——S. 84 E. to N. 84 W.	Tyfoon.
VIII	1819 28th 29th Oct.	H. C. S. Minerva,	——S. 79 E. to N. 79 W.	Tyfoon.
IX	1820 29th Nov.	H. C. S. Lord Castlereagh,	——East to West,	Tyfoon.
X	1821 18th 19th Oct.	H. C. S. General Kydd and General Harris,	——N. 74 E. to S. 74 W.	Tyfoon.
XI	1822 14th 15th Sept.	H. C. S. Macqueen,	——S. 57 E. to N. 57 W.	Tyfoon.
XII	1826 25th 27th Sept.	H. C. S. Castle Huntley,	——S. 77 E. to N. 77 W.	Tyfoon, 7½ miles per hour.
XIII	1829 9th Aug.	H. C. S. Bridgewater,	——East to West.	Tyfoon.
XIV	1829 8th & 9th Aug.	H. C. S. Charles Grant, Lady Melville, &c.	——S. 78 E. to N. 78 W.	Tyfoon.
XV	1831 23d Sept.	At Canton.	——N. 68 E. to S. 68 W.	Tyfoon.
XVI	1831 23d Oct.	At Manilla and the Panama's first storm,	——S. 68 E. N. 68 W.	Tyfoon.

No. of Track.	Dates.	Names.	Track of Storm.	Remarks.
XVII	1831 24th 25th Oct.	Panama's second storm, ..	From S. 45 E. N. 45 W.	
XVIII	1831 25th 26th Oct.	Fort William, ...	——N. 74 E. S. 74 W...	Perhaps Monsoon.
XIX	1832 3d August, ..	At Canton and Macao, ..	——East to West	Tyfoon.
XX	1832 22d 25th Oct.	Moffatt, ...	——N. 45 E. to S. 45 W.	Perhaps Monsoon.
XXI	1833 28th August, ..	Brigs Virginia and Bee, ..	——S. 40 E. to N. 40 W.	Tyfoon.
XXII	1833 12th October,	H. C. S. Lowther Castle, ..	——N. 12 E. to S. 12 W.	
XXIII	1835 3rd July, ..	Barque Troughton, ...	——S. 34 E. to N. 34 W.	
XXIV	1835 4th August, ..	H. M. S. Raleigh, ...	——S. 72 E. to N. 72 W.	
XXV	1837 16th 22d Nov.	Ariel and Vansittart, ...	——S. E. and curving to S. W. ..	Tyfoon and Monsoon.
XXVI XXVII	1839 22nd 24th Sept.	Calcutta Thetis, London Thetis and Golconda, ..	——S. 10 E. to N. 10 W. ——S. 78 E. to N. 78 W.	Golconda foundered.
XXVIII	1840 29th 30th Nov.	French Frigate Magicienne and St. Paul, ...	——S. 75 E. to N. 75 W.	Tyfoon, perhaps 24 miles per hour.
XXIX	1841 21st July, ..	Hong Kong Fleet, ...	——N. 45 E. to S. 45 W.	Tyfoon.
XXX	1841 26th July ..	Hong Kong Fleet, ...	——S. 56 E. to N. 56 W.	Tyfoon.

It appears from this table that—

1. If we class the storms according to the monsoons in which they occur, we shall find first as to the *times* of their occurrence.

N. E. Monsoon October to May.	Tyfoons seem to occur in October and November* only.
S. W. Monsoon May to October.	Tyfoons occur in all the months from June to October.

There is thus, we may say, but little chance of a violent storm from December to the end of May, *as far as our present knowledge extends,* and the disturbing force of the S. W. Monsoon against the regular N. E. trade seems to be a great cause, if not *the* cause, of these tempests. It is true that the N. E. Monsoon, (which is really the trade wind,) is considered to be fully established in November, at the surface of the earth, but we may suppose that there may be still some disturbing forces from the remains of the influences of the S. W. Monsoon acting in the higher regions. This sort of *vibrating* of some of the November storms, (*Vansittart's* and others,) to which I have alluded, may be noticed as affording some countenance to this view of the subject.

Considering these tables as to the probable tracks of the storms in the different months, we have the following results:—

			Average of Tracks.
June. ...	No. XI.	From East to West.	From East.
July. ...	„ I.	—— N. 68° E. to S. 68° W.	From between N. E. and S.E.bE.
	„ XXIII.	—— S. 34° E. to N. 34° W.	
	„ XXIX.	—— N. 45° E. to S. 45° W.	
	„ XXX.	—— S. 56° E. to N. 56° W.	
August.	No. XIII.	—— East to West.	From between East and S. 40° E.
	„ XIV.	—— S. 78° E. to N. 78° W.	
	„ XIX.	—— East to West.	
	„ XXI.	—— S. 40° E. to N. 40° W.	
	„ XXIX.	—— S. 78° E. to N. 72° W.	
Sept.	No. III.	—— S. S. E. and E. to W.	From between N. 60° E. and S. 10° E.
	„ IV.	—— N. 77° E. to S. 77° W.	
	„ V.	—— N. 60° E. to S. 60° W.	

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* At Manilla they are *said* never to occur after the 30th November, the feast of St. Andrew, the patron saint of that city, which is celebrated with much pomp.

			Average of Tracks.
Sept.	„ VI.	From N. 78° E. to S. 78° W.	From between N. 60° E. and S. 10° E.
	„ VII.	—— S. 84° E. to N. 84° W.	
	„ XI.	—— S. 57° E. to N. 57° W.	
	„ XII.	—— S. 77° E. to N. 77° W.	
	„ XV.	—— N. 68° E. to S. 68° W.	
	„ XXVI.	—— S. 10° E. to N. 10° W.	
	„ XXVII.	—— S. 78° E. to N. 78° W.	
October.	No. VIII.	—— S. 79° E. to N. 79° W.	From between N. 12° E. and S. 45° E.
	„ X.	—— N. 74° E. to S. 74° W.	
	„ XVI.	—— S. 68° E. to N. 68° W.	
	„ XVII.	—— S. 45° E. to N. 45° W.	
	„ XVIII.	—— N. 74° E. to S. 74° W.	
	„ XX.	—— N. 45° E. to S. 45° W.	
	„ XXII.	—— N. 12° E. to S. 12° W.	
Nov.	No. IX.	—— East to West.	From between N. E. and S. E.
	„ XXV.	—— S. E. & to N.E. & S.W.	
	„ XXVIII.	—— S. 75° E. to N. 75° W.	

We must recollect in considering this, and all the other results which this Memoir offers, that we are very far from possessing all the data for the period of time over which it extends; as, up to the opening of the trade with China and the establishment of opium-clippers from Calcutta and Bombay to that country, the China Sea was in certain months rarely navigated by English ships, and of those few (Indian country ships, Americans and others,) which did navigate at those times, we have not a single record; all this should be duly borne in mind, and that the most we can expect are approximate results only from imperfect data. Another consideration also should not be overlooked, which is, that the tracks of the storms *seem* to be influenced by the quarter in which they arise, and that a ship off the Coast of Luconia, or in the S. E. part of the China Sea, in the angle formed by the Philippines and Palawan, may have more chances of a storm coming up from the Southward of East, than one between the Macclesfield Shoal and the Grand Ladrone. This consideration also should not be forgotten.

In my introductory notice I have remarked, that when we cannot prove the theory wholly by the evidence deduced from one storm, we may prove it in parts by the careful analysis of separate storms. I now proceed to shew how far we have, as it appears to me, done this.

I should state here, that I have as carefully looked for contradictions as for confirmations of the usual law, and for tracks of storms from the Westward as well as from the Eastward; but in no instance have I been able to find data which would admit of this supposition, while all are, as it seems to me, easily and simply accounted for by assuming the rotation from left to right in the Northern hemisphere and tracks from some point to the Eastward of the meridian. Of the progression again, though we have not in the confined space and track which the China Sea affords, such direct evidence of it as we have in the Bay of Bengal, yet we have some, as in the case of the *Magicienne* and *St. Paul*, and the *Raleigh* which are direct enough, and we have again and again, which is perhaps of more importance, the increasing strength, varying direction, sudden changes, contrary shifts, and decreasing violence of the storms, which are exactly what *should* occur with a progressive whirlwind. The *Raleigh's* storm, so ably analysed by Mr. Redfield, and the Manilla and *Panama's* first storm are clear instances of well-ascertained progression, and the use of the hurricane card will shew that in every instance in which the direct evidence of ships in different positions is wanting, the indirect evidence which this demonstration furnishes, is almost equal to it, for it can be accounted for in no other way.

A third kind of proof may be deduced from those cases, (as that of the *Elphinstone,*) in which vessels, by bearing up, have evidently *chased* and ran into the more violent parts of their storms again, while others by lying to a little longer, have allowed it to leave them.

A fourth kind of proof is also worthy of notice. It will be seen by the log of the *Glatton*, p. 644, which ship was on the southern verge of H. M. S. *Theban's* Storm Track, No. VII., and was standing on, so as to cross the wake of it a few hours after the *Theban* and other vessels had been dismasted, that she crossed the "confused sea" which the passage of the vortex had left. This is always described as creating the awful "pyramidal" sea, a state of the elements of which no man who has not witnessed it can form any conception, and no doubt this confused sea is the remains of it. The same occurred, and most remarkably, to the London *Thetis*, as described in Captain Cass' very able report in my Fourth Memoir.* This ship hove to very carefully on the southern verge of her storm, which was beyond question a rotatory one, and when it had passed her she bore up, and in crossing the track of the centre, she had the sea *heavier* than during the gale! Those who have remarked the effect of a whirlwind crossing a river or a lake, or that of a water spout passing near a ship, will recognise the value of this kind of proof. See also Col. Reid's Work, 2d edition, pp. 474 and 475.

Of the rates at which the storms travel we have very little evidence. In all the instances in which there appears to be any ground for a fair inference I have given it. From 7 to 24 miles per hour, appear to be at present the limits.

As to the circular, or nearly circular form of the vortices, we have I think, abundant evidence. I have again and again, from the logs, projected with every allowance the courses and drifts of the ships, and nothing but the circular theory would account for the winds. Where shifts of wind have taken place, as also where ships have been at a distance, or on opposite sides of a storm, the same rule holds good.

The law for the rotation in one direction, will also I think, be found always to have held good, and that the supposition of the rotation in a contrary course would wholly contradict our data.

One or two other peculiarities remain to be noticed, and the first of these is the occurrence of what may be called double storms, or two storms at the same time travelling on tracks converging towards each other. The *Golconda's* (two *Thetis*' Storm Tracks, No. XXVI. and XXVII.) are a remakable instance of this, and it is a contingency which should not be forgotten by the careful mariner in forming his judgment.

The next is the remarkable abatement in the violence of the weather which appears often to take place a few hours after the storm has commenced, but without any change of the wind or rise of the barometer, and only lasting an hour or two, when it comes on to blow again from the same quarter harder than ever. Old seamen are usually aware of this treacherous peculiarity, but it is one which may sometimes deceive, and thus deserves to be noticed.

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* See also the Table at p. 694, 23d September, at midnight.

A third phenomenon is the very remarkable and dangerous one of a terrific tempest like that of the *Ariel*, without any corresponding depression of the Barometer or Simpiesometer. It is possible, however, that if this last instrument was not very carefully watched, it might have been *oscillating*, though not upon the whole falling, before the storm came on. Still the possibility of such a circumstance should warn the seaman to neglect no precaution.

My last practical remark refers to the highly serious danger arising from the current, or " storm wave," which seems to prevail in some of these tempests as far South as the Paracels, setting generally, it would appear, to the Westward, though in the case of the *General Harris* and *General Kyd* to the N. E. The logs of the *London*, p. 607, *Warley*, p. 612, *Scaleby Castle*, p. 628 and 632, and *Castle Huntley*, p. 651, afford ample proofs of this dangerous current; and I may mention in corroboration, that I have, in original documents and replies to a number of circulars addressed by me to the gentlemen of the H. C. Pilot service, at the mouth of the Hooghly, indubitable proof, that a current of the same kind running from two to five knots an hour, sets over the tails of the reefs to the Westward, in the Easterly and North-easterly hurricanes, at the head of the Bay of Bengal;* besides much evidence to shew, that the devastating inundations which occur along the Coast from the Megna to Coringa, are often caused by a true storm-wave breaking in suddenly, and sweeping every thing before it.

From the imperfect accounts which reach us from China, we may also I think gather, that something of the same kind occurs there.

Before I conclude, I must allude, as a question for research only, to another remarkable feature in these tracks, and indeed all the storm tracks we have yet traced out; which is this: If we look at the chart, we shall see that almost the whole of the storms seem to come in groups from certain quarters, and these quarters are those in which active or half-extinct volcanoes are situated.

Considering our chart in this view of the subject, we shall observe that, to commence from the Northward, six tracks, Nos. XXIX to XX appear to come from the North-eastward, or from the direction of the great volcanic centre of the Japanese Archipelago. Between these we have two tracks, Nos II and XIX, which may be supposed, if they originated at so great a distance, to have come from the active volcanoes at the North extremity of the Marianas, as may also Nos XVIII and X.

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* These will be published as soon as I can complete my Memoir on the Storms of the Sand Heads, and that on the (old) Storms of the Bay of Bengal.

We have then two groups from Nos. VIII to XXVII, which all pass over, if they do not arise from, active or half-extinct volcanoes , the North extremity of Luzon having the volcano of Camiguin and another yet active, and a chain of active or half-extinct ones extend through the almost unknown centre of that island.

We have next a group of three storms, No. XVI to XXI, which appear to issue from the Straits of Mindoro, the Eastern extremity of which has the great volcano of Albay, and to the South of it the half-extinct or active ones of Samar, Leyte and Mindanao; and lastly, we have a group of three tracks which originate at, or cross, the Island of Palawan, which having itself active volcanoes, has also to the South-eastward of it Mindanao and the Siao and Sangir chain of active volcanos.

It may be objected here that since the storms all come from between N. N. E and S S E., and the whole sea is bounded to the Eastward by a volcanic chain at different distances, the storms must necessarily come from some part of it. Allowing all due weight to this objection, the coincidences I have shewn between the quarters or centres from which the storms seem to proceed, or at which they seem to originate, is worthy of attention, and I am not writing now to *prove* any thing, but to suggest points of enquiry for future observers

I have already, p 664 alluded to the well known fact at Manilla, that no hurricane* occurs without some volcanic action more or less violent being observed, and as the whole of the chain of the Philippines, from Mindanao to the Northern extreme is full of active, or partially active centres, far more so even than Java, there seems good ground for supposing some connection; but whether the volcanoes be the cause, or they are agitated by the effect of the atmospheric disturbance, we are as yet ignorant.

In the Bay of Bengal if the tracks of most of our storms be prolong-

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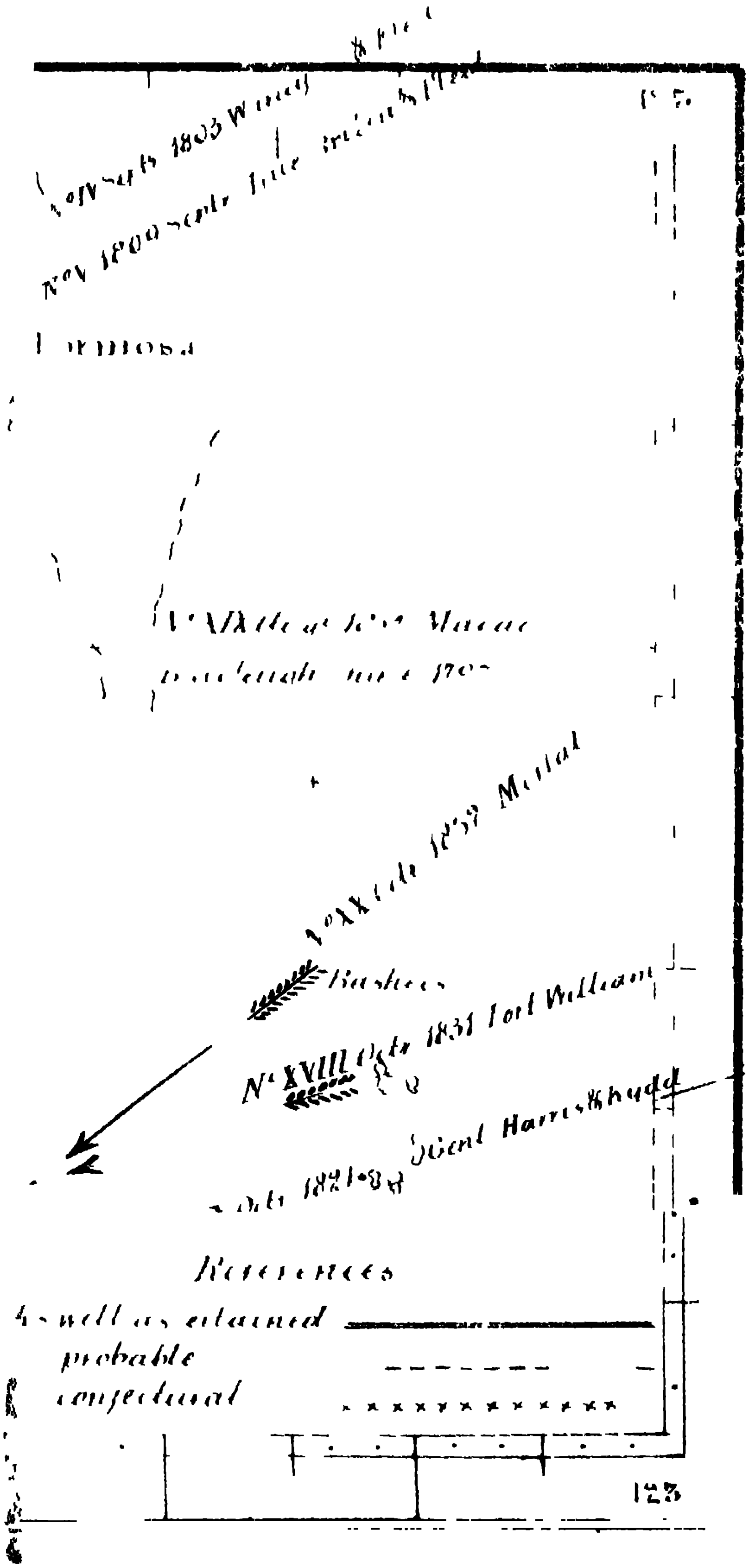
* The Hurricanes are there distinguished from the monsoon gales by the term *Bagio*, an Indian (Tagaloc) word, signifying a turning gale, as hurricane does in the West Indies


1803 Wind
Nov 1800
Formosa
Macao
1839 Metal
Bashees
No XVIII Octr 1831 Fort William
Genl Harris
Octr 1821-8
References
well ascertained
probable
conjectural
123

ed to the S. E., they will all be seen as it were to start from near the yet active volcanic centre of Barren Island ! and some of the old storms which I have traced, certainly do the same. Again, if we look at Mr. Redfield's chart of the West India hurricanes, we shall find them also mostly beginning about the volcanic Leeward Islands. The neighbourhood of Bourbon and Mauritius, and the Timor Sea, where hurricanes seem very prevalent, are all instances of this sort of relation, whatever it may be, if it really exists.

CONCLUSION.

Authors are not allowed to speak of the merits of their works, but I know of no rule which prevents them from pointing out their faults. I would notice here then, that one fault at least of this Memoir is *incompleteness* of information. For this I am not responsible,[*] for I have assuredly spared no pains to render it as complete as possible, but the seaman and the man of science, and every friend to humanity, will I hope not fail to see and to point out, from what has been here accomplished with imperfect data, how much more might be done by more accurate and detailed accounts, and the continued publication of them. It cannot be too often repeated, and therefore I again repeat it here, that we are yet in the infancy of our researches; that valuable as are the practical uses to which they have been turned, we know not yet to what greater results they may lead us, and that, moreover, no one can know *what* the value of any apparently insignificant instance or fact relative to storms may be, which he may have it in his power to communicate.

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[*] To cite one instance (for those acquainted with the Hydrographical History of the China Seas, must think it strange that I have not referred more frequently to the logs of the H. C. Survey Vessels, which for at least ten or twelve years were employed there.) I must state that though three or four applications were made to a party who must be in possession of the logs of one of these vessels, not even a reply was ever received !

Observations on the Herat Astrolabe, described in No. 118, *of the Journal. By the Rev.* J. S. Pratt, *Chaplain to the Right Rev. the Lord Bishop of Calcutta.*

I feel ashamed that I should have kept the brass Astrolabe you lent me so long, without having more to say upon it than I have. But, I am sorry to tell you, that incessant occupation has prevented my giving any time to its examination since the first day that I brought it home. On that day I measured some of the arcs, and tried to discover the use of the curves drawn upon the smooth face, but could not ascertain their use. In fact, it would require a long and close examination and measurement of these instruments, and an intimate acquaintance with the Hindoo and Arabic methods of calculation and observation, which I have no time to acquire, I regret to say—to lead one to indulge any hope of discovering the use and method of handling these Astrolabes. The difficulties that stand in the way of discovering the method of using these instruments, and the object for which they were constructed, seem to be the following :—

1. An ignorance, an entire ignorance of the object in view; though it seems most probable, that the object was to calculate the dates of festivals.

2. The want of a complete knowledge of the *principles* upon which the instruments were constructed.

3. An ignorance of the extent to which the numerical constants used in the application of their principles were erroneous.

4. The imperfection of workmanship in the instrument itself.

Perhaps I may presume to say, that the author of the communication to the Asiatic Society's Journal, No. CXVIII, entitled " A description of a Persian Astrolabe," meaning, I believe, the one I now return to you, does not attempt to give an explanation of the use of the curve lines, which intersect the circular arcs concentric with the instrument itself. Indeed, these lines are wrongly drawn in the diagram. It seems most probable, that they serve some important office in the calculations and observations for which the instrument was designed; and should therefore be carefully examined, and their law of position discovered, to serve as a clue to their use.

Perhaps I may be allowed to say, that from what I have seen or read of the Astronomy of the Hindoos, and also of the Arabs, my own mind has been brought to the conviction, that their knowledge has been very much over-rated. Their knowledge appears to have shewn itself chiefly in the calculation of eclipses; and the phenomena of eclipses being striking and capable of observation by persons of all descriptions, the powers of calculation which have led to their prediction, have excited admiration, and raised the fame of the calculators. But the calculation of eclipses is not so very profound a branch of Astronomy, at least when carried only to the degree of accuracy shewn in Hindoo calculations, as to entitle the Hindoo astronomers to any great fame, except as being attentive observers and moderate geometers. But as to any physical laws, they seem to have been profoundly ignorant, and therefore could not have been *mathematical* or "physical" astronomers. Ancient observations are of great value in Physical Astronomy; for instance, the mere fact of an eclipse having been seen by the Chaldeans on a certain day, and at a certain hour in the year B. C. 720, has led modern astronomers to the demonstrable conclusion, that the length of the mean day has not changed by a hundred and fifteenth part of a second of time within the last twenty-five centuries. This physical fact, of great importance in all theories regarding terrestrial heat, and therefore in the researches of Physical Geology, could not have been demonstrated without the *observed* fact of the Chaldean astronomers. But this observation, (though important in its historical consequences,) does not argue any great power and knowledge in the observers. All *facts* of observation are in a similar way valuable, but do not necessarily prove that the observers are profound philosophers. In this way, by confounding the *value* of *observations* with the *powers necessary* for conducting and recording them, it occurs to me, that the Hindoo and Arabian astronomers have received, in general estimation, far too high a name.

Bishop's Palace, Calcutta, August 11*th*, 1842.

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A Description of the Coal Field of the Damoodah Valley, and the adjacent Countries of Beerbhoom and Poorooleah, as applicable to the present date 1842. *By* J. Homfray, Esq.

The coal field of the Damoodah valley, and its adjacent river the Adji, commences at about the parallel of latitude 23° 16′, and continues uninterruptedly upwards to nearly the whole length of the Damoodah river, until near to its source, which lies in the hills near Ramghur. Along both of its banks lies the mineral coal field, commencing near to the junction of the Singharun Nullah, which falls into the Damoodah river near to the Serampore Indigo Factory. This point at which, however, none of the mineral is found, is the lowest end of a line stretching (nearly direct) across the country to the Adji river, at a place called Seedpoora Ghaut, where also is the extreme limit of the field at the lowest end on that river. This then forms the boundary on the south side, its northern is stated as above; the western limits are the igneous and granitic hills *with their subdivisions,* which lie at a distance, generally of four or six miles from the right, or western bank of the Damoodah, and continue their course to the high lands in the Ramghur district, and crossing through a portion of Chota Nagpore which abuts against the Damoodah and the Barracar rivers, the eastern limits. The North-east, are the range of high hills flanking the Damoodah and the Barracar rivers. Descending this last river to near to Dabystan, it crosses that river, next to where the schistose formation of hills commences, and which run across to Monghyr and the Gurruckpore districts. Bending round with these hills, it crosses over to the Adji river, and thence skirting the foot of the igneous hills, which continue towards Rajmahal, the mineral *decreases* as the distance increases, or as it recedes beyond the Adji river, a small portion, however, alone of this country, east of the Adji, can be called a continuous coal field, and where it descends to a village called Kosta, on the east bank of the Adji, it ceases; and the mineral and its concomitant sand-stone are lost. Eruptions of granite, gness and basalt distinctly mark its limit, until it reaches the very extraordinary mass of gness rocks at the town of Debrazpore, beyond which easterly, there are occasional traces of sand-stones and bituminous shales; and in more than one or two localities immediately beneath the hills, and within the dense forests, traces of very inferior coal are found; and at one locality on the Bermany Nullah, which lies east of Soory or Beerbhoom, about 24 miles, coal is found in quantity, but of a quality so nearly approaching to bituminous shale, as to be unfit for steam purposes. Other localities there are, but the quality of coal remains to be tested; but they are all of them of the same worthless nature as that at Bermany Nullah. I mention this, just to draw attention to a parcel of trashy nonsense, put forth in some publication; something which would induce people to believe, that the Sylhet and Burdwan coal field, (as it is there called) have some, or had some connexion, which by a marvellous occurrence has been disjoined, and that Sylhet and Chirra Poonjee are now journeying towards the moon. There is no more similarity between the coal and its concomitant rocks in the Damoodah and that of the Sylhet and Garrows, than between chalk and cheese. None but the most profoundly ignorant of the matter, would entertain a doubt of it. The whole is a mere literary phantasmagoria, got up *ad captandum*, and put forth in [illegible] manner calculated to mislead the unwary. I may be told, that our operations are as yet in their infancy; but I cannot see a trace which long and great experience in such matters would warrant me, or even any unpractised miner, although not educated in the school of modern mineralogists, of snail-hunters and saxo-florists, to arrive at any other conclusion, but that the two great deposits are wholly different. The Damoodah and Adji country is, throughout that portion where the mineral districts lie, one continued line of country which has been subjected to the greatest convulsions of nature, and the immense chains of hills of igneous origin, which are visible throughout, are corroborative of it. The connexion between these hills at distant points, crossing the coal field, is proved by the line of the great basaltic dykes, which protruding through the sandstone up to the surface of the ground, are traceable from one point to another; whilst we have proofs of the changes, which have been wrought upon the materials by these mighty protrusions. It is not very often that the occurrences of the intersection of basaltic dykes is observed. There are, however, within this field, a vast number of these dykes which cross one another, and of course they must have occurred at different ages, as will be seen hereafter, and doubtless the changes in the subterranean minerals have been affected by it. The most remarkable one which causes these changes in the coal field is, one called the Salmah dyke, and one nearly parallel to it at Bharah. These are distinctly traceable for about 30 miles, and have produced a thorough change in the minerals which are deposited on either side of it. The upheave is evidently to the N. E., but to what exact amount I cannot say; but I conjecture from many circumstances which when examined closely into, leads me to think that the dislocation is of some hundreds of feet. The quality of the coal is also changed, and that portion of the coal field hitherto opened upon, and whose mineral has been largely consumed, lead me to believe, that the coal on the south-western, or *lower* side of this dyke, is much superior to that on the North-eastern. There are other large dykes and faults of magnitude which are already discovered, and from which there are many alterations discernible, independent of lesser faults and interruptions such as impede the progress of the miner. At some distance up the Damoodah river on the South-west bank, is the great hill of Pachete, from which innumerable dykes issue; and all around its base, and between it and the river, a space of about four miles, the country although abounding in coal, is full of these dislocations. It is nearly opposite to the centre of this hill, which is about seven miles in length, that the Barracar river unites with the Damoodah. The Baracar rises in the same range of hills as the Damoodah, and continues its course through the hill for some miles, until it is turned by the mighty Parsonath hill towards a more easterly direction, and then thrown towards the schistose hills of the Monghyr range, continuing a rocky stream until it bursts through the schistose rocks near to the Panraw hill, and between it and Dabystan, where it enters the coal field, and continues onward until it abuts against the base of the Pachete hill. The Barracar river has on its northern bank innumerable faults, and all running parallel with it, and as I said before, they are traceable from the Pachete hill and *run* towards the Panraw hill. To the North-west of these dykes, which lie generally at a distance of about one to two miles from the Barracar river, no coal is discovered. The eruption of *greenstone dykes,* which I have not only discovered on the surface of the ground, but by sinking pits I have come down upon them at considerable depths, and found them dipping at a sharp angle, completely cutting off all the minerals, and a change in the nature of the rocks which accompany it, takes place. Within the space of country, between the rivers Barracar, Adji and Damoodah, and a line of country generally four to six miles in breadth, to the South and West of this last river, is the coal field; and glancing at a map, it will be seen it is of great extent, and with little exception, may be taken to be full of coal and iron-stone. The veins, however, are not all of them of such thickness, or of such a quality as will warrant any profitable operations for working the mineral. In some situations the best veins lie at great depths, whilst at others, they are comparatively shallow, and are found to a great extent upon the crop of the vein. Much of the coal hitherto worked and brought to Calcutta, is from such openings, and it is well known, that it is necessary to ensure obtaining good coal that the vein be found and worked from beneath some superstratum; and if that be of sand-stone or shale, so much more likely is the mineral to prove of good quality, and less liable to perish with the weather; wasting its tar as well as crumbling and mouldering to dust, and turning grey coloured so soon as the natural tar has been evaporated.

I shall first place an account of the works now opened, and at which coal is obtained and despatched for sale to Calcutta, commencing at the lowest end, where the Benares new road having passed over the alluvial plain near Burdwan, commences a slight ascent nearer to the jungle of Furreedpore. This jungle, which is of some extent, is upon a red konkary soil, and reaching the dawk bungalow of Kyrasole, which is near to the centre of this jungle; there a reddish sand-stone conglomerate is perceived; thence commences a gradual descent until we reach the Singharun Nullah, before alluded to. This is the first point of the coal field on the south limit. The distance from this point on the Benares road to the junction of the Singharun with the Damoodah is about five miles, and to cross the country northward to the Adji at Seedparah Ghaut is about seven miles, so that the breadth of land between the two rivers of Damoodah and Barracar may be taken on an average of twelve miles. The streams are nearly parallel until the point where the Barracar enters the Damoodah; probably the same causes which were exerted to turn that river to the east have operated to do the same by the Adji, which similarly bends easterly at nearly the same parallel of latitude. Into the Damoodah, or southern river, we trace the following minor streams, proceeding upwards and commencing with the Singharun, which small nullah drains the lands all the way up to Hidgelgurreah hill, situated about three miles from the Adji. In this nullah coal is found to crop out at a distance from the Benares road about one and a half mile, and the basset edge of coal veins are traceable along its bank for about three to four miles. Advantage has been taken of that circumstance to open collieries upon it, and to drain the mine-water into this nullah. There have been workings upon this vein of coal, which varies from seven to nine feet in thickness, ever since 1832, but success has not attended the operations, as the object of despatching the coal by the way of the Adji river down to the river Hooghly has proved both dangerous and expensive, and the coal obtained therefrom, probably owing to its proximity to the surface, has been of inferior quality. Late openings have been made with a view of conveying it to the Damoodah, which is five miles distant, to which it has to be carted at considerable cost; whilst to the Adji, that distance is from the nearest of those openings six miles, and others seven miles. The line in which this vein of coal is found, continues from the first opening alluded to across the country and to the Hidgelgurreah hill, and thence across the river Adji into the Beerbhoom district. Although even near to the Adji, it is not discovered of so great a thickness, the vein having evidently " thinned out" towards the village of Beercoltee. The first opening or lowest down the stream is that by Messrs. Erskine, being the one now whose coal is conveyed by carts to the

Damoodah. A mile and a half higher up, are the openings of Mr. Rogers and Mr. Blake. This last gentleman commenced in 1832, with a view of conveying its produce down the Adji; but hitherto the greatest extent has not exceeded a few thousand maunds, such is the ungovernable nature of that stream and the shallowness of water, and dangerous rocky bottom, that all efforts to overget it prove unavailing. There is but one way of turning the Adji to any account, which is by conveying the coal in carts lower down the river, about 25 to 30 miles, and where the river navigation is less dangerous, although even from that point it is much inferior to its equally ungovernable brother the Damoodah. The vein of coal is but one along this line, and when one reaches to the Hidgelgurreah hill, and between it and the Adji, the iron-stone measures are found cropping out; these I shall hereafter notice. The next nullah above the Singharun, and on the same bank, is the Nooneah. This is the most considerable of all those minor streams at its confluence with the Damoodah, where are situated the collieries of Messrs. Carr, Tagore, and Co.; and Messrs. Gilmore and Homfray, both of which adjoin each other, and are at a distance of only a few hundred yards from the main river. The popular name of Raneegunge, is derived from the proprietary rights of one of them having been vested in the late Ranee of Burdwan, and which also gave rise to the equally fallacious term of Burdwan coal. These collieries have their pits sunk down to the main vein of coal, generally to a depth of ninety feet, the vein varying from seven and a half to eight and half feet in thickness; the covering immediately over the vein is dark shale, and over which is a soft friable sand-stone, and which enables the vein to be excavated in openings of generally four yards in width; the working underground being conducted on the pillar and stall system, and with so excellent a roof over the coal it allows full three-quarters of vein to be excavated, the principal loss or waste of coal being attributable to its nature, being a free burning or non-binding coal. The small, or dust, which is produced in its working being of no value, is left in the hollows of the work. Fortunately, there is no appearance of fire-damp in this vein of coal, and the whole system of working has enabled them hitherto to be kept extremely well ventilated. This vein of coal is perceptible for seven or eight miles up this nullah, and is found cropping out in very many places in that distance, until it is found where the Benares road crosses this stream, and within two miles of the Assensole dawk bungalow.

Although there are no great impediments to the present works by faults, still they exist around and within these collieries to some extent, and it is evident from the view any scientific person would take of it, that but for such dykes, this noble vein would discover itself in many other places; but no where between these collieries, and those of Singharun is there any visible traces, though beyond a doubt the vein lies beneath the whole extent of ground between these nullahs. Higher up this nullah about one mile, and near to the village of Damooleah, the coal is also worked; it was originally opened and worked by Mr. Jessop and its produce carted to the Damoodah; its proprietary right is now vested in, and exercised by, Messrs. Carr, Tagore and Co. Higher up the nullah, and near to the Benares road, there is another opening by the same proprietors, called Moishla or Damarah, the produce of which is carted about two and a half miles to the Damoodah. Between this locality and the Damoodah near to Cheluad, a pit has been sunk 100 feet, and has passed through two small veins of coal similar to those found on the opposite, or south-western bank of the river at Salmah, where a pit was commenced to be sunk by me in 1831, and after a cessation of two years, has been continued until the present time, June 1842. It has reached a depth of above 210 feet, and has passed through seven different veins of coal, and one of iron-stone. None of these veins, however, are of a description that would warrant mining operations thereon, varying in thickness from 16 inches to three feet only, and are of an inferior quality. I am still sinking, with a view to attain a vein of about seven feet thickness, and of excellent known quality. The strata which have been passed through in this pit, are the usual ones of sand-stone and shale, but differing from any others that I have met with in this country, and approaching closely to those in the English coal fields. The grain of the rock assimilates, and the characters which usually distinguish fruitful mineralogical strata are all present, whilst those met with in the sand-stone of the other collieries, are very unlike the usual ones accompanying coal in England, although the shales are similar, and contain the usual floriform and herbaceous impressions of vegetables; these are also here found both in the shales and in the sand-stones. This pit is within a hundred yards of the great Salmah basaltic dyke, and at a distance of 600 yards lower down the river is the accompanying dyke at Bharah. They run to the south-westward nearly, but not quite parallel. One of these is traceable to the neighbourhood of Telindah, where is an abrupt conical hill, an offshoot of those hills which constitute the western boundary of the coal field all the way up to Pachete and towards Ramghur. The other dyke is traceable to the same range of hills near to the village of Rampore. The distance from Salmah and Bharah is about six miles.

Near to my pit, these dykes, which are each of them about twelve yards in breadth, cross the Damoodah river diagonally, and after continuing their course nearly a mile along its bank, they gradually tend towards each other, and the Bhara dyke intersects and crosses that of Salmah, at a place called Juggernat Ghaut. The Salmah one continues in full breadth across the country, through the village of Damarah, and several others towards the Adji, and is traceable for the distance of very many miles. The Bharah dyke, where a point intersects that of Salmah, continues its course through the country, but in a different direction, running towards Herahpore, and near to which it also meets another basaltic dyke of lesser magnitude, which I trace from Majeet, and they seem to have united, for I lose all trace of it thereafter. The dyke then turns a little more eastward, and continuing onwards, crosses the Benares road between Gopalpore and Neamutpore, and continues on towards Dabystan and to the schistose hills in that neighbourhood. It is these two main dykes which have caused the alteration in the strata, since the veins which are found on one side have not found corresponding ones on the other. Proceeding up the Damoodah on the south-west bank near to Berooee, there is a nullah called Tentooleah which falls into it, and which takes its rise in the igneous hills at the back or western side of the Pachete hill. This nullah skirts the base of the Beharrynauth hill; it is extremely rapid and rocky. Within this nullah the various small veins of coal met with in the pit at Salmah are here visible, and when close to the base of the Beharrynauth hill, a fault throws up the strata, bringing to view a vein of coal of about seven feet thickness and excellent quality. There are I believe not less than nine different veins which lie above this, and two rich veins of iron-stone. To attain this vein of coal, my pit at Salmah is sinking. The proximity of the hill is such, that the strata around these are in much confusion, and at its base at the upthrow fault, the whole of the coal measures and their concomitant sand-stone are cut off at once; the country becomes immediately changed from a barren rocky surface to that of a fair cultivatable soil. A line tolerably direct from Beharrynauth hill towards that of Pachete defines the limits of the mineral field on the south-west, about six miles higher up the Damoodah.

Another similar nullah, sometimes called Alroosah, and sometimes Soonaree, runs much in the same direction towards Morelliah village, and in this nullah the same veins are discovered as in the Tentooleah; and are cut off by a similar upthrow fault, probably a continuation of that at Beharrynauth, bringing the same seven feet vein of coal within sight. About two miles above this, and upon the north-eastern bank, is a small nullah called Salinchy; here the strata are seen to be much troubled, and rising at a great angle. Here is situated the Chinacoory colliery, a vein of seven feet, which to me appears to be the same as that above alluded to, and is largely worked by Messrs. Carr, Tagore and Co.; this undertaking was originally begun by Mr. Betts. The vein of coal lies beneath a hard sand-stone rock, and admits of being worked similarly to the other collieries by the manner of stall and pillar, admitting thereby of a large produce being obtained. Around this place of Chinacoory, the strata are extremely deranged, and openings made in different places shew satisfactorily, that the dislocations extend to a depth sufficient to embarrass regular and continuous workings, without the aid of different pits to suit the different distortions. To the westward of this colliery, the vein is thrown up, and lost for a great distance. There is also here a basalt dyke, which runs thence towards the Adji. There is coal also discovered and worked as outposts, or detached workings by the same firm in several places, nearly opposite to Chinacoory on the western bank. Proceeding about three miles higher, and on the same side as Chinacoory, a small vein of coal is found at a place called Dheeshergh ur, and worked by Messrs. Carr, Tagore and Co. The land hence to the union of the Barracar river, seems to contain this vein near its surface. I cannot determine whether it be the same as Chinacoory, as the numerous faults and dislocations hereabouts have materially altered the strata, as is frequently the case from such causes, and reduced its thickness to about three feet. There is no information to be derived from the difference of the strata of rocks which accompany it, and usually serve to guide us and assist our judgment in such difficulties. We are now arrived opposite to the great Pachete Hill, and find ourselves in the country of dislocations and troublous faults and dykes. Here on the south-east bank of the Damoodah, as I before have stated, dislocations occur in every direction beneath that great hill, and between it and the river. Coal, which in my present state of survey I take to consist of two veins, is discovered all the way up to Gautcole, the open vein of it is seen in numerous places, and it is all of good quality. At Gautcole, the river navigation ceases for boats; it is impeded by rapids, and of such fierceness, as to preclude a hope of effecting any passage for boats higher up this river. It is convenient, therefore, to confine my description of the minerals to those which are discovered below this place, although the same continuous field of coal, though much more contracted in breadth, extending but a short distance to either side of the Damoodah, continues all the way to Ramghur, and to the hills separating it from Palamow, and it seems probable, that the coal fields in that district are coeval with the one of the Damoodah valley; but it is remarkable that the quality of the coal, as it approaches to the hills of evident igneous origin in that country, has been subjected to a change for the worse, and upon which I formerly reported in my survey of that country for coal by order of Government. The Damoodah, as I have before stated, has a range of conical hills running parallel with it at a distance generally of four or five miles from its south-western bank all the way to Beharrynauth hill, thence they keep at a greater distance, and stretch by the picturesque village of Baroo, which is the residence of numerous priests with temples raised, some on and some cut from the sides of these conical hills, which stretch away hence to near Rogonatpore. On the south-west of these hills, which I take it are protrusions through the sand-stone formation, and further towards Chota Nagpore, the coal formation is again met with, and it has been a matter of some doubt to me, whether it is not connected with that of the Coyle river and the Palamow coal field; and that the great disjunction of the three coal fields of Damoodah, Coyle, and Palamow is clearly defined by the range of hills before described, running parallel with the river up to Ramghur. Coal is found in many situations in Chota Nagpore, though the veins are deficient in thickness. It remains to be seen, if others of more encouraging quality and sufficiently thick to be worked will be discovered in that wild country. I think it possible, that a previous connection has existed between the coal field of Palamow, Damoodah, and those countries beyond Chota Nagpore, towards the northern part of Cuttack to the sites described by Captain Kittoe, and which are traceable through a great extent of country thence towards the Coyle, and also through Chota Nagpore. The concomitant rocks and shales found in all these countries are extremely similar; nor is there wanting some peculiar veins of iron stone and fire clay, which point towards common and probably coeval formation. The country is so extensive, that years must elapse ere these conjectures can possibly be supported by unerring proofs. But it seems to me indisputable it is not a matter of very much interest as regards Chota Nagpore, as its distance, and the impracticable nature of the country, precludes a hope of finding any demand for its produce of coal.

Returning to Gautcole, and on the north-east bank of the river, we find continuous dislocations, the dykes now appearing to be of greenstone, and the country becomes covered with loose gravelly quartz pebbles and conglomerates. Coming downwards to the rocky island at the junction of the Barracar river, we enter it. This being a subdivision of the Agency of the South-west Frontier, or Chota Nagpore, is subject to the jurisdiction of the Poorooleah Agency. Soon after entering the Barracar, great dislocations are visible, and by the agency of some one of them, a fine vein of coal is brought to the surface of the ground, and upon which I have now two collieries at work. Similar dislocations have again thrown down the vein, and its extreme limit is but a few hundred biggahs. The nature of the mineral differs from any that is found in that part of the country, or within the Damoodah. The coal is of that description called *bending,* though not very strongly so; still it produces an excellent coke, such as is not obtainable from the coals found lower down the Damoodah. It has been found to be the very best description of coal used for steam engines, and far exceeding in value for that purpose any other of the country coals now brought to Calcutta. About four miles up the

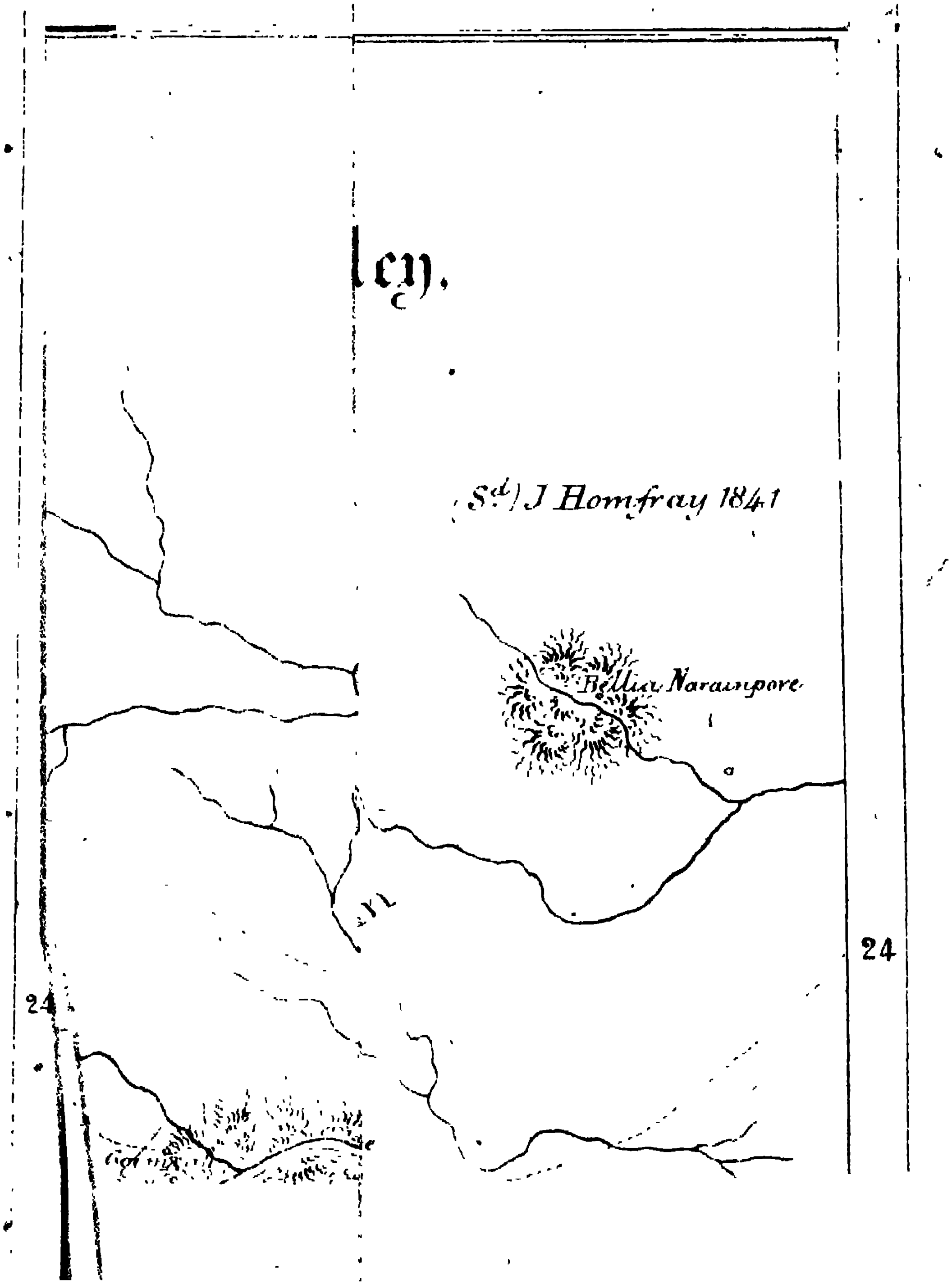
Barracar on the west bank, and a little above the Benares road ferry, another vein of coal, about nine feet in thickness, is thrown up, and is now worked; but its quality is extremely low in the scale of fuel; and at about eight miles further from Barraear, and on the western bank, the sandstone formation is abruptly superseded by the schistose rocks and hills about Panraw, where the Benares road crosses the Barracar at the ferry of Bagooneah; and all around there, the ironstone measures rise out of the river, and are seen basseting out for some miles; the veins of iron are three, of a thickness two to three inches, and very poor in metal. These ironstone measures lie *over the vein of coal,* which is found on the opposite bank at Bermoory, as well as at a place called Ramnaghur, about three miles higher up, and it is traceable all the way across the country to the Adji river, thence across it towards the Beerbhoom hills, and down that river at various places near Jamalpore, Cherooleah, and Hedgelgureah, until the formation is wholly lost near Seedparah Ghaut. Nearly in a line from Begooneah, at which ferry are the great Jeyne temples towards Cherooleah, and at a distance from Mamutpore, on the Benares road of about four miles, is situated the village of Hattoreah Aytoorah. At this place the vein of coal crops out, as also does in many other smaller veins, and here was undoubtedly situated the first colliery ever opened in India by the agency of European superintendence. The remains of old crop workings are still visible near to the village, which were carried on by Mr. Heatly in 1774, or thereabouts, and it was from this place the coals denominated in those days Ramghur coals, were obtained; the whole of this country being at that time subjected to the rule of the Rajah of Ramghur; and it is an historical fact, that Mr. Heatly, at that time being politically employed by Government, captured the Rajah, and probably obtained a knowledge of the existence of coal through some attendant circumstances, and for working which, he was said to have obtained Government permission. It seems the coal was twice or thrice worked, and consumed in the arsenal of Fort William; the records of Government attest the fact, and the reasons assigned for discontinuance of operations were, that the coal did not answer the purposes for which it was required, the work was abandoned, and seems to have lain idle ever since. The line of one of the great dykes passes close to this place, and to its agency probably the out-burst of the vein may be attributed.

From the description of this great coal field it will be seen, that there is no want of the mineral to be apprehended, and that the present collieries are fully capable of producing therefrom any quantity of coal that can be required; but it is not the difficulty of raising, and the production of coal that impedes supply. First, the necessary charge for European superintendence, which is required to conduct money operations, adds an extraordinary heavy charge upon the cost of production. Then comes the capability of river transport, and the difficulty of obtaining such a ghaut on the river as will admit boats to lie ready laden to start off with the mountain torrents. The rivers Barracar, Damoodah, and Adji, all rising in the hills, are navigable only for boats to descend for about ten weeks, and then only at such times as the rain in the hills affords sufficient water to produce a flood in the river; the rapid descent of the river beds seldom allowing a flood sufficient to float a laden boat to remain three days, but more usually two days, for unless a boat starts with the first or beginning of the torrent, it will be difficult for it to reach its destination at Omptah, where the coal depots are situated, before the water shall have fallen to a depth insufficient to bear the laden boat; but empty boats can proceed up the river at all times during the ten weeks. It is therefore necessary for a colliery to have on the river's margin such a ghaut, as where a pond of deep water is situated, and where laden boats can remain till the torrents admit of their departure. Such ghauts are extremely rare, and within the whole distance described on the Damoodah, there are not more than four or five such, where thirty laden boats can remain. It is with the greatest difficulty that the present collieries can manage to keep their extensive number of boats ready laden. This will be easily conceived, when it is recollected, that from the Nooneah Khal, where the collieries of Messrs. Carr, Tagore and Co. and those of myself are situated, if a flood succeeds after a period of ten days' absence of it, that a line of coal boats then departing extends frequently six miles in length, and is perhaps one of the prettiest sights that a stranger can witness. The channel of the river wherein alone the boats pass down, is extremely tortuous, very narrow, and constantly changing from the effects of the sudden rise and violence of the torrent. Very many boats of the finest description in Bengal are lost by falling foul of each other; and once upset, these boats are usually dashed to pieces on the rocky sides of the river, or else sink with their load to an irrecoverable depth in the quicksands.

In order to be able to load these boats with rapidity, it is next of consequence to have the coals ready at the ghaut; this imposes the necessity of keeping the colliery at work throughout the year; the coals therefore are seldom sufficiently fresh when they are sent to Calcutta, for it is only those worked during the ten weeks' time that can be strictly so called. The consequence is, that the coal being subject to exposure for so many months to the heat of a tropical [illegible]n, has its innate tar and coal-oil greatly evaporated. This is the cause of its apparent inferiority to that imported from England, which is usually put on board ship within a day or two of its exit from the coal pit, and arrives at Calcutta without ever having been subjected to exposure. The coal of the district when fresh, will bear a favourable comparison with the average of coals imported from England, and that from Barracar is a very little superior to it ever imported. The great drawback to a cheaper supply of coals to the Calcutta market is attributable mainly to the two great causes of loss in weight by this exposure to the weather, for it is not only the nine and half months at the river ghaut, but there must afterwards be a twelve months stock at Calcutta to supply the market with, until the river again becomes navigable. These two periods will be found to be an average of *twenty months* to be subject to exposure; and the next is, that there is an interest of money on the outlay for the same period of time. I doubt much if any remedy at the present rate of demand for coals can be applied. Nei[illegible] rail-roads nor canals with the present annual demand for a quantity [illegible] about 40,000 tons, (although the present collieries could treble their produce directly,) could compete with the comparatively cheap transport by the ungovernable river navigation, which bad as it is, still permits the coals to be conveyed to Calcutta at an average charge of seven shillings per ton. Although the general price for first class Steam coals is now rated at six annas per maund, or about twenty shillings per ton, whilst there arises a great deal of breakage into small and dust, which abstracts from its quality their price about one-fifth, so that the first class Steam coal may net to the vendor twenty shillings per ton, still the average will not exceed sixteen, and although he has a heavy delivery charge to sustain, the miner at this price is supposed to be amply paid for his undertaking. Again, supposing the plan of a rail-road or a canal to be entertained, to what place should it direct its highest point, so that branches may be formed to the various collieries now open, and others which would doubtless follow? The most expensive part of the undertaking would lie within the line of the mineral field wherein the collieries are now working, which we may take at twenty miles in length. Any undertaking of this nature must be conducted to the extreme point; those most favoured at the lowest point would otherwise possess a virtual monopoly of supply. It is a just source of complaint, that at the present day the right of passage, or way-leave, to the river can be so exercised as to prevent the minerals from reaching the line of navigation of the river, which is an open, free, and untaxed road to the market of Calcutta; but any petty landholder possessing a biggah of ghaut land on the river's margin, may prevent the interior of the country for miles from pouring its resources to the capital, by what seems to me impolitic, withholding of a regulation to open these ghauts to public use. There is scarcely a canal or rail-road act in England but has some clause to oblige persons possessing lands applicable to such purposes, to accept a compensation for its use, settled usually by a jury of assessors. Why should not the rule for what is required for public purposes in that country, be applied to this? The present demand for about 50,000 tons by the removal of such obstacles as these, and many others of a similar nature, may be extended to double or treble that quantity in a year's time, if there was a demand for it, as the costs of the coal at the present day is much enhanced by these sorts of demand, which tell grievously in the accounts of a small concern. These observations apply to the whole of the river-ghauts.

The iron worked within this mineral field is generally the produce of the thin veins which crop out on the surface of the ground, and is smelted now in but a very few locations; but the whole country has in different places been subjected to the workers of iron. Scarcely a spot of five miles square within this field but the scoriæ of iron are found in great quantities; and it would seem, that as the country became subject to the cultivator, the iron smelter retreated further into the hills and forests. At present, the only place where iron smelting is carried on within this field is near to Gautcole, and beneath that range of hills, and towards Soosnah on the south-west side, and beneath the Beerbhoom Hills on the north-east; but no where east of the Barracar, and between the Damoodah and Adji.

Having thus described the country, I may mention, that in the Damoodah coal field, not a trace of limestone has ever been found, nor in either that of Chota Nagpore or Cuttack; and its absence throughout this and the neighbouring coal field of Palamow will convince any one, how different are the formations of this field from that in Sylhet, the Garrows, and Assam, where the noble limestone rock is found to accompany the coal throughout the whole of those countries. I cannot claim any honour, as others have done in the publication alluded to, for a discovery of coal as it is called, ten miles within the delta of the alluvial formation, and in the midst of the paddy fields; but I hope that what I have above stated, may prove instructive to such as think it worth while to inquire into the resources of the country. There is an account in the "Gleanings of Science," of the coal and colliery of Raneegunge, by Mr. Jones, and I should not have mentioned it, but it is erroneous in the extreme; and at the time he wrote it, I am certain it was based on very limited survey. It cannot be relied on at all, not even the section of the vein at Raneegunge, which is there made out to be seventeen feet, instead of half that thickness from the surface of the ground. We procure lime konkar, and this is the only calcareous production known hereabouts. Limestone, in the way of profit, would be far more coveted than coal; but we have it not. Fire clay of fair quality is found beneath the coal of some veins, but not universally. When properly selected, I have seen excellent fire bricks made therefrom, and have seen them used successfully in Messrs. Jessop's foundery. A porcelain clay is also found extensively near to [illegible] hills on the south-west of the Damoodah, but the admixture of foreign matter unsuits it for fine ware. I had some coarse pottery made from it in England, but they failed to produce fine ware. It is evidently decomposed rocks, and I take it, assimilates to that of China. In its native state, and by careful ablution, it might get rid of the impurities, but it is unadapted for pottery.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The hills around the south-west extremity, and near to the Subanreeka, contain a very poor description of copper, which is stealthily worked by the natives. The ore is very poor in metal, so also in the Beerbhoom district, and not very distant from where the coal is found in the Braning ruin. At a place called Doomka, there is lead found in several places, but that is also poor in metal. It probably is an outlier of the same plumbose formations as is found near to Deoghur, although twenty-five to thirty miles distant.

Talc is found in many places in the neighbouring hills, but the plates are not very large.

One might suppose, that where sandstone is found throughout this country, that some good paving stones might be obtained, but with the exception of two places, I have never met with any sandstone which separates in beds. At Cherooleah, on the Adji, large quantities were formerly raised, but were principally hewn from large boulders of sandstone and loose outlying rocks; the grain is very coarse, and the stone soft. It however answers well for common purposes, but is unfit to be applied to fine work.

NOTE.—Aytura, Chinacoory, and Damoully, (Mr. Homfray's Damooleah) were three of the six mines opened by Mr. Heatly in 1774. The scattered position of these over the country, shew that the field had been explored with some attention at that early period, and its most capable spots determined with judgment. Chirooleah also lies within the limits applied for and granted to Mr. H. So little appears to have been done since, as far as regards the examination of the great coal field of these districts, that though the early discoverers speak uniformly of Beerbhoom coal, and Pachete coal, and even Mr. Jones, "saw nothing to indicate the existence of coal in the Burdwan district," the publications of the Coal Committee invariably term this the Burdwan field, an error that might lure some sanguine capitalist into speculations like those of the Bexhill Colliery on the Hastings' Sand, chronicled by Sir John Herschel, (Disc. Nat. Phil. p. 45). The silence of the same authorities has compelled me to support a narrative of the early history of coal, (placed in Mr. Torrens' hands) by rather tedious quotations from public papers, as its authenticity might otherwise be called into question, since the Committee having easy access to Government records, and this being their special province, appear to be unacquainted with the facts.

S. G. T. H.

A Monograph of the species of Lynx. By EDWARD BLYTH, *Curator to the Asiatic Society.*

As the Lynxes are a group of Cats pre-eminently attached to frigid and mountainous regions, it is remarkable that none has hitherto been observed on the Himalaya, where the widely diffused *Felis Chaus* of Guldenstadt (vel *F. Kutas*, Pearson, *F. affinis*, Gray, and *Lynchus erythrotis*, Hodgson,) appears to be their only representative, this being rather a Lynx-like Cat than a true Lynx, though one of an unbroken series of gradations passing from the domestic Cat group into the present form, and which series is finally connected by *F. Caracal* with the typical or northern Lynxes—the Caracal according with the latter in wanting the small foremost upper false molar-tooth which exists in all other known Cats, while it is deficient in the facial ruff and mouchetures so characteristic of the animals under consideration.

That more than one species of this minor group inhabits the wooded Elboorz chain stretching eastward from the southern extremity of the Caspian, there is every reason to consider probable; and "the Lynx"* is included by Capt. Thos. Hutton in his enumeration of some of the mammalia of Afghanistan, *(Calc. Journ. Nat. Hist.* I, 558,) in which country "a large wild Cat, with a tendency to the Lyncean tuft on the ears," (most probably the *Chaus)*, is noticed by Dr. Griffith to be met with about Olipore (*Journ. As. Soc.* X, 978). Mr. Hodgson has obtained a species in Tibet (*Ibid.* XI, 276), which, from the dimensions ascribed to one of his specimens, would seem to be *F. cervaria*;† an animal chiefly found to the eastward of the Ural range, and rarely on the Caucasus, but which is known in Persia (according to M. Menetries) by the appellation *Vaarchach*. As I have had good opportunities of making myself acquainted with the various species of this group, and it appears to me that descriptions of them in this Journal will be of utility in enabling observers to discriminate any they may meet with, I shall proceed to offer an account of each of them, drawn up from personal examination of specimens in every instance.

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* *In orig.* "three Lynx," a typographical error which, from the context, I read as above.

† Since writing the above, having seen Mr. Hodgson's coloured drawing of the animal in question, I can pronounce it to be *F. cervaria*.

The Lynxes may be characterised as merely short-tailed Cats, of middle size, with a tuft of lengthened hair at the tip of each ear, and wherein the small foremost upper false molar-tooth, which appears to be constantly present throughout the rest of the genus, is regularly deficient in the adult, if not in the young also. The Caracal excepted, they have a ruff of lengthened fur bordering the sides of the visage, beneath which is a pointed tuft pendent on each side of the throat, denominated their *mouchetures*. In general, they are light-made animals, with contracted flanks, and rather high on the limbs, and the fur of most of them is in winter long and very dense, having deciduary whitish tips, which more or less conceal the under-colour, but are gradually shed at the approach of summer, when the ground-tint has always a rufous cast (more or less bright, according to the species), and is variously spotted with black, the markings inclining to form oblique streaks on the flanks: the pendent mouchetures are white, with a black line near their outer border, beyond which the edge is of the hue of the body; the ears have the usual dark marks at the base and tip (common to most of the genus), and which shew very conspicuously in winter, from contrasting with the nearly uniform hoariness of the fur generally,—as does also a black tip to the short tail, which latter is more or less ringed above this, and has a very truncate appearance.

These typical Lynxes are solitary in habit, and frequent mountain-forests, where, however, they seek their prey chiefly on the ground; but climb trees with facility, to which they usually resort on apprehension of danger. They are timorous animals, but very destructive to lambs and calves, fawns, and specially to feathered game and hares; but they seldom attack larger animals, and only, perhaps, when urged and rendered desperate by famine. They commonly reside in some rocky cavern or burrow of their own excavation; where the female produces two or three kittens in the spring. Their voice much resembles that of the domestic Cat, only uttered in a fuller and deeper tone: and it may be remarked that the talons of these animals, though slender, are highly formidable, being adapted rather for prehension, or seizing their prey, than for tearing away the skin of it, which latter seems to be the chief purpose to which the Lion and Tiger apply these weapons, after disabling their victim by a single blow of the tremendous paw, with the talons not exserted.*

As many as four species occur in Europe.

The Great Lynx (*F. cervaria,* Lin.; *F. borealis,* Thunberg, but not of Temminck). This is by much the largest and most powerful of the group, with teeth—the canines at least—fully equal to those of a Leopard, and a comparatively robust frame, appearing more so from the length and fulness of its beautiful fur, which is highly valued by the dealers in peltry. Its length approaches to three feet and a half, and height of the back upwards of two feet: the ears are rather small, only one inch and three-quarters long, and but slightly tufted; and the facial ruff is very conspicuous, the mouchetures hardly appearing below it, though nearly three inches in length. The upper canines are exserted an inch and a half from the gums, and are very stout in proportion. Fur excessively soft and dense, most delicately fine in texture, and two inches long, in winter, upon the back; of a lively rufo-fulvous, or bright rust-colour, underneath (or in summer), and tipped with glistening ashy-white in winter, imparting a fine lustre, besides which is a slight tinge of carneous more or less perceptible: it is marked with distantly placed irregular black spots, sometimes rather large, and more or less lengthened obliquely on the sides; three rows of these appear conspicuously along the croup; and the limbs have smaller spots, and are but little marked on their inner surface. The most esteemed skins have the spots small, and a lustrous greyish-white surface, with a distinct blush. The young, according to M. Temminck, are covered with brown spots in addition to the black ones.

This species is the *Siberian Lynx* of the furriers, and would appear to be principally found in Northern Asia, from whence the skins are mostly brought to Moscow. On the Caucasus, it seems to be rare :* and it doubtless extends northward along the forests of the Ural, being likewise found, though as a rarity, in Scandinavia, where it is designated *Kat-lo* (or Cat Lynx). I suspect it to be the Tibetan species of Mr. Hodgson.† Pontoppidan, in his 'Natural History of Norway,' by some inadvertence, asserts that this *Kat-goupe* "is scarcely half the size of the next, or *Warg-goupe.*" Of its particular habits I have met with no information.

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* So far as I have observed, a Lynx's claw is always keenly pointed, whereas in wild-shot specimens of the other great *Feles* alluded to, the talons are often very much split and broken away at the extremity, evidencing the roughest usage, but may be peeled away underneath with facility till they become sharp enough for any purpose. The fact is, they continue growing, but, like a rodent's tusk, are of much softer substance behind or underneath than in front; and as soon as the point is broken away, a horizontal split commences, and the under lamina soon shreds off: the point, being harder, is apt to grow inconveniently long; and hence a common practice of all the genus, which the house Cat is too fond of performing upon the legs of chairs and other furniture, the Jaguar always resorting to a particular individual tree of the forest for the same purpose, and the Puma (as noticed by Mr. Darwin) making deep scores in the bare hard soil of Patagonia.

The Red Lynx (*F. Lynx*, Temminck, but not of Linnæus and Nilsson; *F. virgata*, Nilsson). This is the ordinary European species, which alone is found in the central parts, though now very sparingly, extending from Scandinavia to Naples, and to the Pyrenees, whence it may be suspected to have wandered into Spain, though it is not known to have occurred in that country. It is a long limbed animal, appearing so more particularly in summer, when its coat is short; the pupils of its eyes close vertically; and the facial ruff is moderately full, with the mouchetures appearing conspicuously below it. A fine living male stood nearly two feet high at the croup, with a length of about three feet to the tail, the latter about six inches more; ears fully three inches, with tufts an inch and a half, and the mouchetures an inch and three quarters. The fur is short in summer, but in winter is much longer, with pure white tips almost concealing the bright rufous under-colour: the latter is darker along the middle of the back, paler on the sides, and the under-parts and inside of the limbs are white; the body-markings are obscure, and in some individuals not a little resemble, when sufficiently brought out, those of the Ocelot (*F. pardalis*); forming dusky spots on the limbs only, and faint ocellated streaks descending obliquely backwards on the sides, the inferior border of which ocellations is much more strongly marked (as in various other species), and in some specimens almost solely discernible. The tail is rufous above, whitish underneath, and rather largely tipped with black: the borders of the eyes are white, with a black line proceeding obliquely backward and downward from their outer corner; the upper lip is spotted, and the under one margined, with black; and the facial markings resemble those of the other streaked species of *Felis:* irides greenish-hazel. The young resemble the adults.

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* It is, however, the only species that was noticed on the Caucasus by M. Menetries, who obtained the spoils of one at Bakan, which he was positively assured was killed in that country.

† See Note to p. 18.

This Lynx is the commonest species of the forests of Scandinavia, and the only one which is occasionally met with in the southern parts of that country during severe winter weather. It is there termed *Warg-lo* (or "Wolf Lynx"); that is, in Sweden, being the *Warg-goupe* of Norway. In former times it appears to have been very generally diffused over Central Europe, and it is still sparingly found in the wilder mountain forests of Germany, Poland, Hungary, Switzerland, (where M. Schinz mentions that it is extremely rare), and according to M. Temminck in Italy as far as Naples, and very accidentally France. Baron Cuvier notices its occurrence on the Pyrenees. In Russia it is more numerous; and M. Guldenstadt states that it is common upon the Caucasus,* whence it probably spreads eastward and northward into Central Asia. An interesting notice of this animal occurs in Major Lloyd's 'Field Sports of the North of Europe' (II. 139, *et seq*). This author does not appear to have been acquainted with more than this one species, observed both in summer and winter dress, which he rightly refers to the same animal; and concerning it, he mentions that "they are to be found in some abundance in all the more deeply wooded districts of Scandinavia. They are usually to be met with singly, or at most in pairs, unless it be, perhaps, that the mother is followed by her cubs. They generally confine themselves to the wildest recesses of the forests, and are rarely to be seen in the vicinity of inhabited places.

"The period of gestation with these animals is from eight to nine weeks, and the female brings forth about the beginning of May: this is either in the cavity of a rock, or in other sheltered situations. It is said that the mother [like the rest of the genus] gives her whelps living animals, the better to initiate them in the art of killing their victims.

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* I follow Temminck in referring Guldenstadt's *F. Lynx* to this species, although the evidence is not very conclusive. Guldenstadt defines it as "capite et corpore albidô rufô maculatô, caudâ obsoletè annulatâ, apice nigrô;" which applies almost as well to *F. cervaria*. It is probable, however, that the present species is intended.

"The Lynx is a most destructive beast. He kills the young of Elk, Deer, Roe-buck, Hares, &c., and also the Capercaili, Black-cock, and other birds common to the northern forests. He likewise destroys the smaller domestic animals, such as Sheep, Goats, Calves, &c. When he gets among a flock of Sheep or Goats, it is said that, if he be unmolested, he slaughters the whole of them. He has been known to attack and kill even a Horse.* The Lynx, it is asserted, never touches carrion or putrid flesh;" nor, indeed, do any of the genus, unless very severely pressed by hunger, when even a Tiger has been seen to make a meal off a putrid carcass.

"The Lynx is little dangerous to the human race. I never heard of his attacking a person, unless molested in the first instance. If he be wounded, he will sometimes turn upon his antagonist [much smaller species, as the British Wild Cat, will do the same]; indeed, more than one instance has come to my knowledge, when, thus circumstanced, he has severely lacerated his assailant. It is not difficult to kill him with a good Dog, for, if closely pursued, the animal usually takes refuge in a tree, which he ascends with the agility of a Cat. In that situation, it is, of course, easy for the sportsman to destroy him. If the Dogs take the Lynx by surprise, and he is unable to shelter himself either in a tree, or in the cleft of a rock, it is said that he throws himself on his back, and defends himself desperately with his claws. He is, however, as much afraid of a bite in the foot as a Lion."

It must be to this species, also, that Pontoppidan's notice mainly refers, when speaking of the Scandinavian Lynxes, he writes — "These animals go out like the Wolf, except that they do not appear so publicly in the open flat country, but keep more to the woods, and lurk in holes of the earth, which they dig for themselves deep and winding; but they are driven out with fire and smoke. In the day-time they lie hid, and steal upon their prey, which they watch for, crouched up like Cats, at the entrance of their holes. They are very nice in their food, and of a Sheep or Goat do not eat more than the head or udder; by which circumstance one knows what animal has been there. Though they always kill, they eat little in the increasing moon [?], but in the decrease are more ravenous, and will hide or bury the carcasses like a

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* This was probably *F. cervaria;* but it will be remembered that the Norwegian Horses are remarkably diminutive.—E. B.

Bear. The wild Cat is their worst enemy, for its almost constant employment is to look out for them in their holes, and steal their prey from them. They are very cunning in undoing a sheep-fold, where they help themselves very nobly. When attacked by a Dog, they throw themselves immediately on the back, in the manner of a Cat, and turn up the fore legs, to be the better able to defend themselves; the Dog on this lays hold, but the Lynx *(Goupe)* then makes use of his sharp claws so effectually, that he flays his enemy alive."*

The specimens of the *Red Lynx* which I have seen, in captivity, have all been more or less tame, especially a fine male which was living in the Zoological Society's Garden at the time I left London; this was perfectly gentle and familiar, as much so as any domestic Cat; it courted notice in the same manner as that animal, by purring and arching up the back, and raising its short tail, which at other times was ordinarily carried closely appressed, as in the Caracal: the latter animal I have also repeatedly seen quite tame; but not so the Bay and Pardine Lynxes, which were shy and mistrustful, for ever growling and spitting at persons who approached them, and (the individuals) seemingly altogether untameable; so likewise are a couple of kittens of *F. Chaus* which are now more than half grown, and which I have possessed from the time they could scarcely crawl, and have uniformly tried to subdue their savage disposition, but wholly without success. They will allow me to touch them, but never suddenly or abruptly, nor do they ever fail to greet me with a spiteful hiss, and when I venture to smooth their fur, they throw back their ears as if frightened, and resume their growling and spitting the moment I take my hand off; and so it has been with them from the very first, when they could not have had their eyes open many days. Lieut. Tickell tells me, that he also has found the *Chaus* thus utterly untameable.

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* "It happened lately," continues this author, "that a *Goupe* making his way into a sheep-fold, was discovered by a sly old he-Goat, who perceived his subterraneous track, watched him narrowly, and as soon as he had come forth, before the body could be got out, butted him, and gave him such home-pushes, that he laid him dead in the grave of his own making."—*Nat. Hist. of Norway,* II. 21.

Here it may be remarked, that the existence of the European Wild Cat in Scandinavia has been denied by later authorities, though Pontopiddan further states, (at p. 8,) that "we have Cats both tame and wild; the latter are very large, and their skins bear a good price; they live by watching birds upon the trees, and then seizing them with a sudden spring." This is quite the habit of the British Wild Cat, which usually lies dozing or watching for prey upon a low pine-branch of its own colour, where it cannot easily be discerned. M. Nilsson (as cited by Major Lloyd) states, however, that the true Wild Cat does not inhabit Scandinavia, though a stray domestic Cat may now and then be met with in the forest. The *F. Catus* of Linnæus is clearly the domestic species; and the Faunas of Bilberg and Retzius throw no distinct light upon the subject, failing to distinguish the two species apart; which is also the case in Müller's *Prodromus,* where reference is, however, made to Von Aphelin's Work, (II. 299,) which I have had no opportunity of consulting. M. Ménétries notices that the European Wild Cat is not rare in the Cisalpine forests of Caucasus, where the Russians style it *Kowka,* or Wild Cat; a name which, according to Pallas [following Guldenstadt], is bestowed on *F. Chaus.* It descends in winter to the Steppes. Temminck asserts that, in Hungary, Russia, and the Asiatic countries, this animal attains a larger size, and yields a more esteemed fur, than in Western Europe; though I incline to doubt whether the largest British specimens are anywhere surpassed.

The Pardine Lynx *(F. Pardina,* Oken and Temminck). If the preceding species does not extend its range into the Spanish peninsula, its place is there supplied by another, remarkable for the beauty of its spotting, and the length of its pendent mouchetures, which is not known to occur out of that country. The Pardine Lynx is inferior in size to the ordinary Red species, but measures upwards of two feet and a half to the tail, the latter six inches more; and height of the back about a foot and a half, or rather more. The ears are two inches and a half long, or with their tufts three inches and three-quarters; and mouchetures two inches and a quarter. The fur is short and soft, three-quarters of an inch long upon the back, and of a vinous-fulvous colour, paler on the under-parts, and very handsomely spotted with black; the markings inclining to form linked ocellations on the sides, which are of a deeper colour within than the general ground-tint, as usual in all ocellated markings. On the limbs are round spots, which become smaller and tend to group into ocellations above them. The tip of the lower and margin of the upper lip are black, above which the latter is spotted; and the back of the ear is grey in the centre, broadly surrounded with black; the margins of the eyes being white as usual. The mouchetures, also, are conspicuously white, finely set off by the black line near their outside; but there is no other white except on the throat. I doubt whether the fur is ever much tipped with whitish in winter, though there is probably some appearance of it. The ground colour of the young is paler, with the spots less intense.

To the continental furriers, this species is known, according to M. Temminck, as the Lynx of Portugal. Col. Sykes obtained two skins (of an adult and young) at Seville, where they cost him thirty reals, about six shillings and three pence. " In Andalusia, whence the specimens came, the animal is called *Gato Clavo (Clavo* meaning the pupil of the eye), illustrative of the spotted character of the fur. Some peasants in Andalusia make short jackets of the skins. The animal inhabits the Sierra Morena."* M. Temminck suspected that it might also be found in Sardinia, and perhaps Sicily; while the Lynx of Italy and Naples is known to be the Red one. He further conjectured that it may inhabit Turkey and the Levantine countries. No notice of it occurs, however, in Sr. Cetti's work on the quadrupeds of Sardinia, where the only wild Feline appears to be a feral race of the Domestic Cat, with generally black fur, as noticed by Azuni, and which is numerous in all the wooded districts of that island. The specimen here described is a fully adult male, received when young by the Zoological Society from some part of Spain, and which lived till it attained complete maturity in their establishment. The anterior false molar proved to be wanting in its upper jaw, as in all the allied species here described.

The Arctic Lynx (*F. Borealis*, Temminck, but not of Thunberg; *F. Lynx,* Linnæus and Nilsson; *F. Canadensis,* Geoffroy). This fourth European Lynx appears to be common to the wooded districts of the extreme north of both continents. It is readily distinguished by the indistinctness of its markings generally, including those of the limbs, though on the belly there are spots which, in some individuals, are tolerably distinct; and particularly by the shagginess of its paws, the fur covering which is remarkably long and dense, recalling to mind the feet of some of the Arctic birds, as the great Snowy Owl and certain Ptarmigan. This animal bears even a further resemblance to the Owls, in the manner in which the hair of its face meets to form a mesial ridge between the eyes, which is very strongly marked; whereas in other Cats, although some trace of this may generally be found, it certainly requires to be looked for, to be observed. Its length is about two feet and three-quarters from nose to base of tail, the tail with hair only four inches more; height of the back somewhat exceeding a foot and a half. The ears are two inches long, with copious tufts that sometimes attain to two inches, and the ruff and mouchetures are considerably developed, the latter measuring three inches in length. The coat generally of this species is in winter long and very dense, measuring, at that season, an inch and three-quarters upon the back: in summer it is of a yellowish-buff colour, greyish, or mixed with white, having black tips along the middle of the back; and in winter, (or when in season, as the furriers style it,) it is silvered over with hoary tips, the black extremity of its very short and particularly truncate tail, and the black tips and long pencil-tufts of the ears, contrasting in a striking manner with the almost uniform hoariness of the fur generally; its paws have a wide spread, and look immense; their aspect being quite different from that of any of the others. The facial markings of this species are scarcely, even when at all, perceptible, and of numerous heaps of the skins which I have examined, it was very seldom that any trace of spots could be discerned, even upon the limbs: the fur of the under-parts, however, which is longer, has some distantly placed rather large black spots upon a white ground, resembling those of the next species, and which are more or less brought out in different individuals.

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* *Proc. Zool. Soc.*, 1838, p. 113. From the same mountain range, a Mungoose (*Herpestes Widdringtonii,* Gray), allied to the Egyptian *H. Ichneumon*, has recently been described by Mr. Gray, in the 'Annals and Magazine of Natural History' for March 1842, p. 50, certainly a very unexpected addition to the Mammalia of Europe.

This Arctic species, according to M. Nilsson, is the *F. Lynx* of Linnæus, as indeed was indicated by the words "manus amplissimæ," though the expression "corpore rufescente maculatâ" certainly applies much better to the *F. Lynx* of Temminck, which, as being now generally known by that appellation, I prefer still to style so, perceiving no advantage in altering the established denominations with M. Nilsson. M. Temminck united the Scandinavian and Hudson's Bay animals, after comparison of a vast number of skins; and M. Nilsson's coloured figure of a Swedish specimen might pass equally for that of an American one: it may, nevertheless, surprise, that this species is not generally included in the catalogues of observed mammalia, which are appended to the narratives of the different Polar expeditions; but the reason appears to be, that it is everywhere rare near the sea-coast, keeping to the wooded districts of the interior; Captain Back being the only navigator who notices it.

The Arctic Lynx is confined to the northernmost forests of Scandinavia, where it is known as the *Rislo*, or *Raf-lo* ("Fox Lynx");

and it appears to extend throughout the corresponding latitudes of the whole eastern continent, spreading perhaps to the southward in Siberia, and along the forests of the Ural. It is doubtless the species common in Kamtschatka, and it takes a wide range on the western coast of North America, as the Zoological Society possess a specimen from California. In the United States, it appears to be only known as a very rare straggler; and the only recorded instance which I know of its occurrence within the northern territory of the Union is published in Silliman's 'Journal' for 1837, p. 194, where a specimen is mentioned to have been tracked and shot, at Southington, Connecticut. Its weight was thirty-two lbs. and length nearly three feet; the tail about four inches. "Though not entirely agreeing with Dr. Richardson's description", remarks the writer, "it was probably *F. borealis*". There is no other known species which it could have been. Hearne remarks, that "it is very rare to the North of Churchill [on the *barren-grounds?*], but is there exactly the same as those found to the South-west. They never approach near the settlement of Hudson's Bay, and are very destructive to Rabbits [small American Hares], seldom leaving a place which is frequented by them till they have killed nearly all."—"It is the only species of the genus," remarks Dr. Richardson, "which extends north of the Great Lakes, and eastward of the Rocky Mountains. It is rare on the sea-coast, and does not frequent the barren-grounds, but it is not uncommon in the wooded districts of the interior, since from 7,000 to 9,000 skins are annually procured by the Hudson's Bay Company. It is found on the Mackenzie River, as far north as latitude 66°. The early French writers on Canada, who ascribed to it the habit of dropping from trees on the backs of Deer [which Brickell and Catesby likewise assert of the Bay Lynx, being further rendered probable by the known sanguivorous propensity of the ordinary European species,] gave it the name of *Loup Cervier;* but the French Canadians now term it indifferently *le Chat* or *le Pechoo*".

Dr. Richardson further relates, combining the descriptions of Hearne and Dr. Godman with his personal observation, that this Lynx "is a timid creature, incapable of attacking any of the larger quadrupeds, but well armed for the capture of the American Hare, on which it chiefly preys. Its large paws, slender loins, and long but thick hind legs, give it an awkward clumsy appearance. It makes a poor fight when it is surprised by a hunter in a tree, for though it spits like a Cat, and sets its hair up, it is easily destroyed by a blow on the back with a slender stick, and it never attacks a man. Its gait is by bounds, with the back a little arched, and lighting on all the feet at once. It swims well, and will cross the arm of a lake two miles wide; but it is not swift on land. It breeds once in the year, and has two young at a litter. The natives eat its flesh, which is white and tender, but rather flavourless, much resembling that of the American Hare." The latter accords with the statement of Dr. Shaw respecting the flesh of the Lion, which this author compares to veal; and it is borne out by the personal experience of Mr. Darwin, in the instance of the Puma, which is commonly eaten by the Guachos of South America. Buffon, therefore, may have been writing from supposed analogy when he asserted that the flesh of the common European Lynx, "like that of other carnivorous animals," is not good to eat.*

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* It is indeed a question, to what extent the excessive repugnance with which the idea of eating the flesh of Carnivora is usually entertained, be not mere educational prejudice, as an immense host of authorities might be cited to testify. Mr. Darwin, as above noticed, in his extremely interesting 'Journal' (p. 135), relates, "At supper, from something that was said, I was suddenly horrified at thinking I was eating one of the favorite dishes of the country, a half-formed calf, long before its proper time of birth. [This reminds one of an esteemed dainty of the ancient Romans; namely, a gravid *uterus suillus !*] It turned out to be Puma; the meat is very white, and remarkably like veal in taste. Dr. Shaw was laughed at for saying that the flesh of the Lion is in great esteem, having no small affinity for veal, whether in colour, taste, or flavour; such, certainly," continues Mr. Darwin, "is the case with Puma. The Guachos differ in opinion, whether the Jaguar is good eating; but are unanimous in saying that Cat is excellent."

Similar testimony in favour of Dog's flesh might be adduced, and not only as regards the meat of such as are reared exclusively on vegetable diet, but of those which take their chance and find their own subsistence as they may. Mr. Townshend (in his recent 'Narrative of a Journey across the Rocky Mountains' of North America) states, that he has often eaten and relished it, and has no other objection to this diet than the sentimental one of repulsiveness, at having so faithful a servitor and friend of man heartlessly butchered to appease his appetite. In Norway, I may remark *en passant,* a breed is reared solely for the sake of their fur, which has evoked a similar remark from De Capel Broke and other tourists in that country. Capt. Lyon mentions, of the Arctic Fox, that "the flesh, which was very fat, had so good an appearance, that many trials were made of it. All were horrified at the idea of eating Foxes, but very many soon got the better of their delicacy. Not being myself very nice, I soon made the experiment; and found the flesh much resembling that of kid, and I afterwards frequently made a supper of it."—*Private Journal,* p. 90.

Of the quality of *Viverridæ* meat, I do not remember to have seen or heard of any remark, nor do I suspect it would be otherwise than rank and unpalatable: but of the *Plantigradu,* or Bears, Raccoons, and their allies, and of the Badger tribe, all of

The BAY LYNX (*F. rufa,* Guldenstadt; *F. maculosa,* Vigors and Horsfield, *Zoological Journal; Mississipi Lynx* of Buffon, and "Wild Cat" of the United States of North America). Size averaging that of the Pardine Lynx, or smaller than the last species, with much shorter fur, and a very full facial ruff, the mouchetures not appearing below it. From nose to base of tail, it measures about two feet and a half, the tail five inches, and height of the back about sixteen inches; ears an inch

which are vegetable-feeders to a considerable extent (as indeed are also most *Viverridæ),* abundance of favourable testimony might be collected. Vide Major Lloyd's 'Field Sports of the North of Europe,' II, 46, and the Hon'ble C. A. Murray's 'Travels in the Western Regions of North America,' II, 59. Even of the fetid Skunk of the latter continent, we are informed, in Carver's Travels (p. 452), that "Europeans who have fed on them, after the receptacles of the odorous fluid had been carefully extracted, have found them very sweet and good." If this animal be seized and lifted by the tail, it cannot squirt its fluid, and, like other creatures with a sensitive nozzle, it is easily killed by a blow on the snout. Formerly it was customary to eat the Otter, on lenten days, *for a fish !*

With regard to Bear's meat, it should, however, be mentioned, that the flesh of the great Polar Bear appears to have sometimes proved decidedly unwholesome; yet in the Appendix to Capt. Parry's 4th Voyage, it is stated to be "free from any disagreeable taste; it proved a valuable and timely addition to our stock of provisions, and served materially to restore the strength of the party." Hence it may be suspected that the effects resulting from the use of this aliment, noticed in the narrative of one of Capt. Ross's Voyages, are attributable to some particular food the animal had been eating, or even, possibly, to some adventitious circumstance affecting the tone of the digestive operations in the men.

Among the *Insectivora,* Cuv., the respectable editor of the 'Literary Gazette' gives his personal testimony that the flesh of the Hedge-hog is excellent; and there is a notice, in the 'Magazine of Natural History', of a Mole-catcher who was in the habit of eating the Moles he caught, and said that "if folks generally knew how good they were, but few would fall to his share." To cite an instance from among the *Edentata,* Cuv., the Armadilloes are exceedingly foul feeders; yet all who have partaken of it agree that one, "roasted in its own shell," is most delicate-eating.

In the feathered class, I remember that M. Audubon declares, that he has never eaten the flesh of Cormorant, nor, so long as he can help it, will he ever do so, or words to that effect; but M. Schomburgk has assured me that he has frequently eaten of the Cormorant of Guiana, which is really very good, after having been (like other water-fowl) skinned previously to dressing: and very lately a gentleman informed me that he had repeatedly partaken of Anhinga *(Plotus),* a genus closely allied to that of the Cormorants. Indeed, some London readers must not be too sure that they have not themselves feasted off a plump Cormorant; for I have been credibly informed of an instance of a man carrying a row of these birds upon a pole through the streets, and seeking to vend them to the Londoners by the familiar cry of "wild Ducks, wild Ducks, oh!" Of the egg of the Cormorant, the same friend has assured me, that he was much surprised to find how good they were; and there is reason to suspect that any eggs of birds described as otherwise, were none of the freshest when tasted.

It is said that a Buzzard, and particularly a Pern, or Honey Buzzard, is esteemed an excellent dish in some parts of France.

and three-quarters long, or, with their tufts, half an inch more; and mouchetures, which barely acuminate below the considerably developed ruff, an inch and three-quarters at most. The fur is seldom more than an inch long upon the back, or at most an inch and one-eighth; and is of a grey-brown colour, more or less tinged with rufous, much as in a rusty tabby Cat, or as in the *Chaus;* and marked all over with small round dark spots, indistinct on the back, and, in some, all over the body, but always well-defined on the limbs, and more or less so above them; enlarging and becoming deeper-coloured downwards,

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People should really be more particular than they are in eating fish, lobsters, &c., to be consistent in following out their notion that the flesh of all carnivorous animals is unfit for the table. Many English gourmands would sicken at the idea of a dish of Snails, which in Hungary, more especially, is esteemed a delicate and is a very frequent viand, so much so that not a few of the peasantry even pay their rents with them (vide Mr. Paget's recent 'Travels in Hungary and Transylvania'); but a Hungarian lady would be fully as much horrified at the thought of swallowing an Oyster, and would, at least, have this advantage over the British epicure, that Snails are vegetable-feeders. One can fancy a civic *bon vivant* commiserating the barbarism of the Persian Princes, who not long ago visited the British metropolis, and testified their abhorrence at the custom of eating Turtle! But that we civilized and enlightened *Carnivora* are altogether free from irrational and totally unfounded misapprehension on the subject of eating the flesh of creatures of prey is, the reader will perhaps begin to think, a little questionable, if he do not go so far as to imagine that a hint might be profitably taken on this subject, as on some others, from the philosophically omnivorous Chinese. At all events, those who are disposed to rail at others for their fastidiousness about eating pork, may ponder awhile upon the reasonableness of their own aversion to partake of various other kinds of flesh, and hesitate before condemning as "unclean" and improper food, what they only presume to be such as a mere matter of course, stigmatizing, by the appellation "carrion," what, in truth, they might have eaten with great relish, had the tide of conventional prejudice happened to flow in the opposite, direction.

A-pro-po's to the foregoing remarks, I have just chanced to meet with a notice in Ellis's 'Tour through Hawaii' (p. 349), which is worthy of being here transcribed. It is well known that the Polynesian natives generally, as well as the Chinese, each rear a particular breed of Dogs for the table, though mainly on vegetable diet: and the *canivorous* propensity is retained by the Chinese in this country; at least I lately saw a well-dressed China-man bargaining for a Corsac Fox in one of the Calcutta bazars, and doubt not that he was prompted thereto by his palate. "Numbers of Dogs, of rather a small size, and something like a terrier," writes Mr. Ellis, "are raised every year as an article of food [in Hawaii, olim *Owhyhee*]. They are mostly fed on vegetables; and we have sometimes seen them kept in yards, with small houses to sleep in. A part of the rent of every tenant who occupies land, is paid in Dogs for his landlord's table. Though often invited by the natives to join them in partaking of the baked dog, we were never induced to taste of one. The natives, however, say it is sweeter than the flesh of the pig, and much more palatable than that of goats or kids, which some refuse to touch, and few care to eat."—*Chacun à son goût. De gustibus*, &c. &c.

and often uniting, more or less, to form transverse streaks on the limbs, similar to those visible on their inner aspect. The belly is clad with longer hair, which is white, with rather large black spots; the summit of the back, and across the shoulders, are darker; the facial markings are more or less brought out, different individuals varying a good deal in this respect; the ears have the basal dark mark distinct, which is not generally the case with the last species; and the tail is obscurely ringed to near the end, where there is a distinct black ring, and beyond it a lateral black spot, which joins that on the other side above, leaving the extreme tip white: the under-surface of the paws and tarsus are conspicuously brown-black (as in *F. chaus*), which is also the case, but in a less degree, in *F. pardina;* and the irides are pale bluish, the pupils of the eyes closing circularly (?). The young (as figured by F. Cuvier by the appellation of "Chat à ventre tacheté,") are clouded with much larger spots, of a darker colour than the general ground-tint.

The Bay Lynx appears to be pretty generally diffused in suitable districts throughout the United States, as more especially in the forests of the Alleghanies and other mountain ranges; extending southward into the Floridas and Mexico. It is also found in California, and about the Columbia river, but it does not occur in the parallel of Labrador. Like the rest, it chiefly inhabits the less frequented parts of the forest, where, in the season, it "makes night hideous" with its loud caterwaulings. It is very destructive to the fawns of the Virginian Deer, young Pigs, Hares, &c. and especially to feathered game, including the wild Turkey in the south. Brickell and Catesby assign to it the habit of dropping from trees upon the backs of Deer, and sucking the blood of its victim. When urged by hunger, it has been often known to follow the footsteps of a hunter, who happened to be carrying the bleeding carcass of a Deer, and become at length so excited, by sniffing and licking at the drops of blood on the ground, as to spring up at the dead animal, and sometimes lacerate the bearer with its talons; but the next moment it will be off and up the next tree, and pursue its course along the forest-boughs with such celerity, like a Puma or Leopard, that, if not shot down at once,—and a wound that does not disable it may exasperate the creature to attack with fury,—it has every chance of escape. When angry, it erects the facial ruff, which helps to impart a savage aspect to the animal.

The above are the only described species of Lynx—putting aside the Caracal—in which, I confess, that I have any confidence, though several others have been indicated by M. Raffinesque as inhabitants of North America, which, at most, I suspect, were varieties of the two last.* According to Dr. Richardson, the late Mr. Douglas was of opinion "that there are more than one undescribed animal of this genus inhabiting the countries bordering on the Columbia. The skins procured in that quarter are generally carried to the Chinese market, without passing into the hands of European furriers." The following passage, however, from a paper on the fur trade, published in Silliman's 'American Journal of Science,' (XXV, 311,) will excite surprise and doubt that any animal so conspicuous should still remain unknown to naturalists. "The fur-countries, from the Pacific Coast to the Rocky Mountains, are now occupied, (exclusive of private combinations and individual trappers and traders,) by the Russians, on the north-west, from Behring's Strait to Queen Charlotte's Island, in north latitude 53 degrees, and by the Hudson's Bay Company thence, south of the Columbia River; from which Ashley's Company, and that under Capt. Bonneville, take the remainder of the region to the Coast of California. Indeed the whole compass, from the Mississipi to the Pacific Ocean, is tracked in every direction. The mountains and forests, from the Arctic Sea to the Gulf of Mexico, are threaded, through every maze, by the hunter. Every river and tributary stream, from the Columbia to the Rio del Norte, and from the Mackenzie to the Colorado of the West, from their head springs to their junction, are searched and trapped for Beaver.

"Almost all the American furs, which do not belong to the Hudson's Bay Company, find their way to New York, and are either distributed thence for home consumption, or sent to foreign markets. The Hudson's Bay Company ship their furs from their factory at York Fort, and from Moose River on Hudson's Bay; their collection from Grand River, &c., they ship for Canada; and *the collection from Columbia River goes to London.*" This wholesale destruction of the fur-bearing animals, and alleged destination of their spoils, seem hardly reconcilable with the opinion that any large species could still remain unknown to European naturalists; and if additional species of the present group existed, especially about the Columbia River, there is certainly no accounting for the total absence of their reliques from among the prodigious multitudes of Lynx skins, from nearly all parts of North America westward of the Rocky Mountains, which find their way to London, and have been diligently examined by myself and others in the store-rooms where (together with other kinds of peltry) they are exhibited previously to each half-yearly sale by the Hudson's Bay Company. From what enquiries I have been able to make of persons who have traversed the western territory of North America, the two well-known species already described appear to be generally recognised as the "Wild Cat" and the "Mountain Cat" or "Catamountain"; and to these, I think, most of the notices of authors may be satisfactorily referred, making some allowance for vagueness in descriptions from memory, or which, perhaps, in some instances, have been given at second-hand. In Brickell's 'History of Carolina' (A. D. 1737, p. 107), a rude figure is published of the "Mountain Cat," though, at the same time, the least bad one in the plate, representing a streaked animal, but which cannot be intended for the Bay Lynx, or common American "wild Cat," as this is separately described by him. It is possible, however, that the Arctic or mountain species is intended, having been designed, perhaps, from mere hear-say. Carver, also, in his Travels (p. 445), mentions the "Cat of the mountain," in addition to the "wild Cat," as being "much larger than a [domestic?] Cat, with similar fur, but differing in colour, this being of a reddish or orange cast, becoming lighter on the belly. The whole skin is beautifully marked with black spots of different figures, of which those on the back are long, and those on the lower parts round. This creature is nearly as fierce as a Leopard, but will seldom attack a man." In this instance, I am of opinion that the term "wild Cat" refers to the Arctic Lynx, and "Cat of the mountain" to the Bay Lynx. Professor Nuttall, in his "Travels in the Arkansas Territory' (p. 118), notices "wild Cats of two colours, both striped and spotted," but gives no further description; and Messrs. Lewis and Clarke assert, that—"The Tiger-cat inhabits the borders of the plains, and the woody country in the neighbourhood of the Pacific. It is of a size larger than the wild Cat [Bay Lynx] of the United States, and much the same in form, agility, and ferocity; but its hair is long and fine, far exceeding that of the animal mentioned. The colour of the back, neck, and sides, is of a reddish brown, irregularly varied with spots of dark brown, the tail is about two inches long, and nearly white, except the extremity, which is black: it terminates abruptly, as if it had been amputated. The belly is white, beautifully variegated with small black spots. The legs are of the same colour as the sides, and the back is marked transversely [!] with black stripes: the ears are black on the outer side, covered with fine short hair, except at the upper part, which is furnished with a pencil of hairs, fine, straight, and black, three-quarters of an inch long"*. To me this somewhat elaborate description appears very much as if it had been drawn up from recollection only, the tail being represented as but two inches long, and the back as *marked transversely*, which is at variance with every other species of Cat known. The country, too, where the animal is stated to inhabit, has now been pretty well examined, and is known to yield the Arctic species, which I cannot bring myself to doubt was that intended by the travellers. M. Raffinesque, however, who never allowed an opportunity to pass of coining a name, whether or not he had seen a specimen, or so much as a portion of one, or even a drawing that could be depended on, has imposed the name of *fasciata* upon the sole authority of Messrs. Lewis and Clarke's description. The same author has indicated, as the Golden Lynx (*Lynx auratus*, Raffinesque), an animal mentioned by Leray ('Voyage au Missouri,' p. 190), who met with it, according to Dr. Harlan, on the border of the Yellow-stone River, near the 44th degree of north latitude, and 32d of western longitude from the meridian of Washington. The animal is described as "one half larger than the domestic Cat, the tail two inches long, and ears penicillated; colour, a clear brilliant yellow, spotted with black and white". The reputed *Catamount* is M. Raffinesque's *Lynx montanus*, to which Dr. Harlan is disposed to refer the *Mississipi Lynx* of Buffon, which is clearly the Bay Lynx, and something else is noticed by him as ***Lynx Floridanus.*** I have not been able to consult M. Raffinesque's paper on these animals, which was published in the 'American Monthly Magazine' for 1817, p. 46; and only know it from the references of Dr. Harlan and others. Should there really be any additional species to those admitted here, no doubt M. Audubon's forthcoming work on the Mammals of North America will include them; but I repeat the expression of my strong suspicion, that none of the foregoing indications will ever be confirmed.

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* It is well known that the morbid eagerness of this eccentric Siculo-American naturalist to distinguish himself as the discriminator of overlooked species of animals and plants amounted, latterly, to decided mania, insomuch that the conductors of different American scientific works to which he sent his papers were compelled, at length, to refrain from giving publication to his frequent and voluminous contributions. Not even the German ornithologist, Brehm, went the length which M. Raffinesque ultimately did in regarding every trivial variation as indicative of specific distinctness. See a biographical memoir of M. Raffinesque in one of the American scientific periodicals (I do not now remember which), appended to the announcement of his demise.—E. B.

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* Narrative of Expedition, III, 28.

With respect to the Lynxes of Scandivania, a notice occurs in Sir Arthur de Capel Broke's 'Travels in Sweden,' &c. (pp. 147 *et seq.*), which in parts is somewhat obscure. "The forests in the province of Drontheim," it is remarked, "abound with different species of wild animals, as Bears, Wolves, Lynxes, Foxes, Martens, Cats,* &c. The Lynx of the north is not rare in this part of Norway. In the Norwegian language it is called *Goupe*, and in the north of Sweden it is generally termed *Wargilue.* From the skins of this animal that were shewn to me in different parts of Norway and Lapland, three of which differed very materially in colour, it seems that there are, at least, as many species or varieties. Of one of these M. Knudtzon had several. The largest measured five feet in length, not including the tail, which did not exceed an inch and a half. The colour of them all was grey, with a yellowish tinge, beautifully marked with dark spots, and the ears were tufted. The general price they brought at Drontheim was about five specie dollars, or one pound sterling. This seems to be peculiar to Norway, as I never observed it during my subsequent travels. [It would appear to be *F. cervaria,* but much stretched, and the tail imperfect.] Of the two others, which I met with in Lapland and Sweden, one that I saw at Urnea measured, from the muzzle to the beginning of the tail, five feet eleven inches [!], and the tail was hardly two inches and a half. The appearance of the skin in every respect so much resembled that of the Leopard, that I should have suspected it to have belonged to that animal, had it not been for its tufted ears, and the length and superior thickness of the fur. [I presume this to have been an excessively stretched skin of *F. cervaria* killed in summer, when the pale tips to the fur had disappeared.] The third species, which I met with in Swedish Lapland, differed very materially from the other two, being of an uniform reddish-brown colour [summer aspect of *F. borealis*]. In length it exceeded five feet [!]. This, which I imagine to be the same as the North American Lynx, and the animal most commonly known by the term Lynx, I have seen alive in the collections of this country, though of a much smaller size." Sir Arthur proceeds to remark on the magnitude of the skins noticed; and if my presumed identifications of them are correct, he does not appear to have been acquainted with the ordinary species of the northern forests, or veritable *Warg-lo (Wargilue)* of the Swedes.

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* Vide Note to p. 24.

The CARACAL (*F. Caracal*, Auct). This well-known species appears to bear that affinity to the Domestic Cat, which the preceding do to the European Wild Cat; and like its analogue, is distinguished by having a tapering tail, in addition to its facile capability for domestication: individuals, however, vary in this respect, as observable in all the higher animals. Length about two feet and a half, the tail nine or ten inches additional; ears three inches, or with tufts three-quarters of an inch more; and height of the back sixteen or eighteen inches. General colour bright fulvous-brown, silvered over with whitish tips in winter, and paler on the under-parts, with some spots generally obscure, but sometimes tolerably distinct, on the belly, flanks, and inside of limbs; ears black without, terminating below in a point considerably beyond the ear; no black spot on the border of the upper lip, but one where the moustaches grow, and another above each eye, and there is a line down each side of the nose; extreme tail-tip black.

This animal is common to all Africa, from Barbary to the Cape of Good Hope, where it is not unfrequent; also to a considerable portion of western and even central Asia, being termed *Tsogde* in Little Tibet, and *Ech* in Ladakh, as I was informed by Mr. Vigne, who shewed me an excellent drawing of a trained one he saw in the former country: but if it exist, according to the current statement, in India, it must be only or chiefly in the western parts, not improbably in the same districts as the Lion: for though its range is asserted in the *Dict. Class. d'Hist. Nat.* to extend from Barbary to Bengal, and Mr. Ogilby mentions it as met with in most parts of India,* while various other authorities might be cited to the same effect, yet it is neither included in Col. Sykes's list of the Mammalia of the Deccan, nor in the elaborate Catalogue of those of the Southern Mahratta country by Mr. Elliot, neither can I learn of any trace of it in Bengal; Mr. Hodgson omits it in his list of Nepâlese Mammalia (*J. A. S.*, X, 908), and, proceeding eastward, Dr. Griffith among those of Assam. It is even likely that, like the Cherrug Falcon, trained individuals may be occasionally brought from beyond the Indus, and that such have erroneously induced the statement that they were indigenous to the provinces where seen. It is said to inhabit Arabia, as well as Persia, and it is not unfrequently designated the ***Persian Lynx***, being trained, especially in that country, to creep and spring upon game, in the manner of the Cheetah. This animal is the *Karrah Kulak* of Persia, *Gat el Khalleh* of Barbary, and bears the name of *Seer-gosch* in India. M. Temminck states, that the wild Caracals hunt in packs of several individuals, pursuing and attacking game in the manner of wild Dogs; but this, I should say, much requires confirmation; as does particularly its claim to be considered as indigenous to India.*

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* 'Mammalogy of the Himalaya,' p. 10.

There is a ***Felis aurata***, Temminck, (not *Lynx auratus* of Raffinesque,) which appears to need further establishment as distinct from the Caracal. It is described as rather smaller than that species, with tail half the length of the body, a brown band along the median line of the tail, but the extreme point black. Ears short, rounded, not penicillated; the coat very short and lustrous. All the upper-parts are very bright rufous-bay and spotless, with indistinct streaks of a somewhat deeper tint on the flanks; lower parts reddish-white, marked with large and small spots of maronne-brown; ears perfectly black without, and reddish within; limbs golden. Length three feet four inches, of which the tail is twelve inches and a quarter. Described from a skin purchased in London, locality unknown.

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* Since writing the above, I have been assured of one having been killed near Jubulpore, in central India.—E B.

Selections communicated by the Suddur Board of Revenue at Allahabad, from Correspondence respecting the proposed formation of a Canal for Irrigation to be supplied from the River Jumna, near the Village of Kuttha Putthur, in the Deyra Doon. From Captain P. T. Cautley, *to the Secretary of the Suddur Board of Revenue, North Western Provinces, Dooab Canal Office, Camp Hurdwar, 29th April,* 1841.

Sir,—In the Revenue Survey of the Deyra Doon completed by Captain Brown, that officer notes "that the lands north of the Sutwala Row in general, may be irrigated from the Jumna, by a Canal cut from Domayut, but the excavations would be expensive."

2. During the late cold season, I took the opportunity of examining the country, which would be benefited by such a work as Capt. Brown refers to, and as I was on the spot, this examination naturally led to a further inquiry into the practicability or not of getting water out of the Jumna upon the high land; the results, which for the satisfaction of Government I have put into form, will be found in the sheet of Plans and Sections which accompany this letter, fig. 1, being a map on a scale of four inches to a mile of the ground over which the Canal will take its course; fig. 2, a map on a quarter of the scale, of the country bounded on the north by the hills and forests of Umbarree and Puthipoor; south by the Asun river; east by the Sutwala Row; and west by the Jumna river. The rest of the figures are longitudinal and cross sections, with plans, &c. of works in masonry which will be required to maintain a regular flow of water.

3. In fig. 2, the course of the Canal is indicated by a blue dotted line, and it will be observed, that as the mountain drainage crosses it at right angles at two points, the whole tract to be irrigated is divided into three distinct portions, stretching from the Canal to the Asun river, the slope of country being in every way favourable to the irrigator.

4. The return of village lands which accompanies this letter shews, that about 17,000 acres of cultivable land will be benefited by this Canal; the country is open with little forest, and only requires a Canal to bring it under cultivation. The want of water* at present prevents the

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* Captain Cautley in a subsequent letter explains, that he here alludes to *drinking* water; and adds,

establishment of villages at a distance from the Asun and Jumna rivers, and the want of population depending on this circumstance will, I imagine, until a Canal is made, interfere altogether with the improvement of this portion of the Doon.

5. The amount of my estimate (Rs. 90,307 : 0 : 0) which depends entirely on the difficulties of the first three and a half miles of the course of the Canal is high, but the return of water, rent, mills, etc. when the water-course is doing its proper work, would render such an outlay admissible.

Thus :—

	Rs.	*As.*	*Pie.*
17,000 Acres, or 27,200 Puk. Begas, @ 5 annas per Bega, ...	8500	0	0
Mills, corn, sugar, sawing, etc.	1500	0	0
Total,	10,000	0	0
Deduct Repairs and Establishment.	3000	0	0
Balance net profit, ...	7000	0	0

or equal to 7¾ per cent.

6. For a detail of the work I must refer you to figs. 1, 4, 5, 6, 7, 8, 9, 10, the latter being the longitudinal section, the capital letters noted on each referring to particular points; the position, elevation, or depression of which will be easily recognized.

7. It was found impracticable to establish a head at Domayut, the steppes into to the river from the high land being not only exceedingly high, but the relative level of the Jumna's water being low, full advantage was not attainable so far down the river; the head which I have established is immediately under the village of Kuttha Puttha, and at the highest point that the mountains would admit of; the head is favorably situated for a supply of water, and as the depth of digging at that

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"In a note from the manager of the Hopeton Grant, dated 25th inst. he observes with reference to the land which would be benefited by the Kuthur Puthur Canal, 'the whole of the lands which you noted as to be commanded by his Canal are still lying waste. Some attempts that I made to cultivate in the outskirts are likely to prove abortive, for the Prithipoor well is almost dry, and the people in that neighbourhood have to drive their cattle to the Jumna for water; they cannot stand out against want of water.' This is characteristic of all the tract coming under the influence of the proposed Canal; the Puthipoor well is, I believe, the only one in existence in its neighbourhood. Water therefore is not only necessary for irrigation, but for the common purposes of life, and consequently, for the concentration of people for agricultural purposes."—*Vide his letter of 26th May*, 1842.

point will be thirty-six inches, the expenses necessary for spurs and bunds will be trifling.

8. From the head to a point at a distance of 4,755 feet, the course of the canal is passed by two rows or mountain streams, one of minor importance having a dam with two openings of ten feet each, the other with a dam of ten openings, as represented at fig. 13. The quantity of boulders, or river stone, in this part of the country will render the execution not only easy, but will enable them to be completed at a very moderate expense. These dams will be precisely the same as those in use of the Doab Canal, with sleeper planks, etc. etc.

9. The second division of the work may be considered as that from the letters A to N, or 18,916 feet; on this line the course of the Canal creeps along the slopes and scarps of the high banks, descending to the Jumna; and the level of the Canal bed, which is proposed to be twenty-four inches per mile, strikes out on the surface of the country at the latter figure. Four mountain streams will be passed by aqueducts, two of them having a span of fifty-one, of forty-five, and the other of twenty-five feet. Care and attention is all that is required to surmount the difficulties of excavation on this line; neither the original labor, nor the chance of after-accident is equal to that which I anticipated on the first mile of the Beejapoor water-course. The soil is full of large shingle or boulders, and the excavation which has been estimated for, is ample to render the work fully efficient. Portions of the line where the Canal comes in contact with high banks is proposed to be constructed of masonry, as represented on the section in fig. 15. The masonry channel will lead to and from the masonry aqueducts, as well as from the dam of ten openings, which I have described as constituting part of the work of the first division, and immediately south of this dam, grooves for sleeper planks will be made in the main channel, so as to keep it clear of water during floods. As the breadth of main channel and that of dam-openings correspond, the same sized plank will do for both.

10. The third division, from the letter N to the Seetla or Sutwala Row, or a distance of 21,834 feet, is plain digging. Six lines of drainage are crossed: two by aqueducts of twenty-five feet span each; four by dam or outlet, one of which has ten openings of ten feet each; and three outlets of ten feet each. The slope of the Canal bed is still continued on a descent of twenty-four inches per miles the extra

slope being overcome by four falls in masonry: one of four and half feet, two of eight feet, and one of twelve feet, which latter will deliver the tail-water into the Sutwala Row, and ultimately into the Asun and Jumna rivers.

11. The facility with which boulders will be procured, and the cheapness of the very best lime, ought, I should think, to enable the persons, who superintend the construction of these works, to do them efficiently on the estimate now submitted.

12. I need hardly advert to the power for machinery which is introduced into the Doon by the construction of these masonry falls. On the Beejapoor water-course, there are 115 descents averaging four feet each. On the Kuttha Puttha Canal, the four proposed falls will place on the high lands means for machinery of every description. It may be long before these means are taken advantage of, but with the growing interest taken in this valley, the annual arrival of new settlers, the certainty that a new generation of Europeans is now springing up, who must look to a livelihood from this country, I see in perspective not only a valley rich in its fields and harvests, but one that will be the centre of an active and manufacturing population.

13. The quantity of water required by the Kuttha Puttha Canal is eighty cubic feet a second. When not used for irrigation, the escape ultimately finds its way back to the Jumna, through the course of the Sutwala and Asun rivers.

14. I am prepared for a question that may be put as to the propriety of going to the expense of this work for using, (advantageously though it may be,) eighty cubic feet of water, when the demand for the Delhi and Doab Canals absorbs during years of drought the whole volume of the Jumna river, and when this eighty feet, now proposed to be turned to account in the Doon, at an expense of 90,000 rupees, would be used in the Doab without incurring any expense at all. In the right that Government has very properly assumed over the waters in the Doon, I merely see the intention of regulating the supply and establishing a supervision, so that the water taken from any river may be applied to the greatest advantage. The inhabitants of the Deyra Doon, who on the west side possess the Asun river rising in their own country, and pouring a supply of water into the Jumna, equal to 600 cubic feet a second, may well be permitted to relieve the Jumna of one-eighth of that

amount; their claim to such a small proportion is infinitely greater than that of others, and as the necessity for water not only for irrigation, but even for drinking, is as great on this tract of the Doon as it is on any portion of the districts under the influence of the Delhi and Doab Canals, this claim to a portion of the Jumna may be fairly conceded.

15. In the case of the Beejapoor water-course, which was proposed to be opened by a private individual, a precedent, and a very judicious one, appears to have been established of preventing a work of this nature, which must ultimately be of service to all, from becoming the private property of one person. Government in the case alluded to, proposed being at the expense of the work, so as to admit of the benefits being equally distributed, both amongst the Native and European farmers. The same argument would apply to the Kuttha Puttha Canal; the expenses of outlay on this work, however, are beyond the means of the holders of the land coming under its influence. This fine tract of cultivable land, therefore, must lie waste unless Government gives its aid in the first instance. I believe, that I have shewn that there are no natural obstacles to the undertaking, and should the return for outlay come up to the estimate which I have made of it, the sanction to carrying the work into effect would, in giving fair interest for the capital expended, be the means of fertilizing a large tract of the valley which otherwise must lie waste and uncultivated.

I have the honour to be, &c.

(*Signed*) P. T. CAUTLEY, *Capt.*
Superintendent Doab Canal.

To H. M. ELLIOTT, ESQ.
Secretary, Revenue Board, Allahabad.

No. 38.

Estimate for the Kuttha Puttha Canal in the Deyra Doon, for the Irrigation of the tract of Country bounded by the Jumna, Asun, and Seetla Rivers, Doab Canal Office, 14*th April,* 1841.

Description,	Measurement.				Cc. ft.	Total Cc. ft.
	L.	B.	D.	No.		
*Kuttha Puttha Dam No.*1.						
Floorings, ...	29	area	114	× 1	= 3306	
Piers, centre and side, ..	3	area	66	× 3	= 594	
Tail Wing Walls, ...	25	× 3	× 5	× 2	= 750	
Front ditto, ...	7 ×	area	48	× 2	= 672	
Total Cubic feet, .	..	..	.	.		5322
Domayut Row Drainage No. 2.						
Floorings, ...	147	area	114	× 1	= 16758	
Piers, centre and side, ..	3	×	66	×11	= 2178	
Tail Wings, ...	25	× 3	× 5	× 2	= 750	
Front ditto, ...	7	area	48	× 2	= 672	
Total Cubic feet,..	.	..	..	..	..	20358
Aqueduct No. 3 *Nulla.*						
Piers, ...	16	× 10	× 17	× 2	= 5440	
Arch, ...	16	× 60	× 3½	× 1	= 3360	
Wing Walls, ...	40	× 3	× 10	× 4	= 4800	
Flooring, ...	150	× 3	× 16	× 1	= 7200	
Parapets, ...	150	× 3	× 4	× 2	= 3600	
Cordon, ...	150	× 1¼	× 1	× 2	= 375	
Abutments to Piers, ...	10	× 1	× 30	× 4	= 1200	
Total Cubic feet,..	..	..	..	..	..	25975
Aqueduct No. 4. Nulla same as above,	..	.	.	.	..	25975
Aqueduct No. 5 *Nulla.*						
Piers, ...	16	× 8	× 13	× 2	= 3328	
Arch, ...	16	× 52	× 3	× 1	= 2496	
Wing Walls, ...	35	× 3	× 10	× 4	= 4200	
Flooring, ...	130	× 3	× 16	× 1	= 6240	
Parapets, ...	130	× 3	× 4	× 2	= 2120	
Cordon, ...	130	× 1¼	× 1	× 2	= 325	
Abutments to Piers, ...	8	× 1	× 24	× 4	= 768	
Total Cubic feet,..	.	..	..	..	..	20477
Carried over Total Cubic	feet.	..	.	..	.. ..	98107

Description.	Measurement.				Cc. ft.	Total Cc. ft.
	L.	B.	D.	No.		
Brought over Cubic feet..	..	..	..	..	..	98107
Aqueduct No. 6 Nulla.						
Piers, ...	16	× 6	× 13	× 2	= 2496	
Arch, ...	16	× 30	× 3	× 1	= 1440	
Wing Walls,..	22	× 3	× 6	× 4	= 1584	
Floorings, ...	80	× 3	× 16	× 1	= 3840	
Parapets, ...	80	× 3	× 4	× 2	= 1920	
Cordon, ...	80	× 1¼	× 1	× 2	= 200	
Abutments, ...	6	× 1	× 24	× 4	= 576	
Total Cubic feet, ..	..	..	..	..	..	12056
Aqueduct No. 7, same as above,	..	..	..	..	..	122219
Outlet No. 8 Drainage.						
Floorings, ...	16	area	114	× 1	= 1824	
Piers,..	3	area	66	× 2	= 396	
Tail Wing Walls, ...	25	× 3	× 5	× 2	= 750	
Front ditto, ...	7	area	48	× 2	= 672	
Total Cubic feet,..	..	..	..	..	..	3642
Outlet No. 9 Drainage, same as above, ...	..	..	..	..	..	3642
Aqueduct No. 10, same as at No. 4, ...	..	..	..	..	..	12056
Dam No. 11, same as Domayut Row Drainage,.	..	..	..	..	..	20358
Outlet No. 12 Drainage, same as No. 6, ...	..	..	..	..	..	3642
Masonry Water Channel Area Section 26 × 10560	..	..	..	..	..	274560
Total Cubic feet of Masonry,		..	..	..	..	440119

Earth Work.

On the first 23,671 feet in length the Canal either crosses the Steppes or traverses the Bank, dipping into the valley of the Jumna. The superficial soil is clay and sand, that under it shingle; where the Canal traverses the Banks, the excavation will be done without Cooli labor, by throwing the shingle and earth over the sides.

1st Portion,	7431 ×	15 ×	20	 2229300
2d Portion,	16240 ×	25 ×	20	 8120000
3d Portion,	21834 ×	20 ×	6	 2620080

Total Excavation, .. 12969380

Masonry 440119 *Cubic feet*

Of which 40,119 Cubic feet, @ 16 Rs per 100,	6419	0	7
„ 100,000 ditto, @ 12 Rs per 100, .	12000	0	0
„ 300,000 ditto, @ 8 Rs per 100,	24000	0	0

Earth Work 12969380 *Cubic feet*

Of which 10,349,300 Cubic feet, @ 3 Rs per 1000, .	31047	14	5
„ 2,620,080 ditto, @ 2½ Rs per 1000,	6550	3	2
4 Falls with Bridges attached, 150 Rs each,	600	0	0
2 Bridges Villages, @ 60 Rs. each, .	180	0	0
2 Mills, @ 500 Rs each, .	1000	0	0
100 Planks for Dams 10½ feet × 1 feet × 2½ inch with iron straps, &c. complete, @ 3 Rs each,	300	0	0
Total Co's Rs	82097	2	2
Add for Contingencies, .	2809	13	10
Grand Total, Co's Rs ..	90307	0	0

Assignment required on the Saharunpoor Treasury.

(*Signed*) P T CAUTLEY,
Superintendent, Doab Canal

Return of Village Lands in the Deyra Doon, which will come under the influence of the Kuttha Puttha Canal, extracted from Captain Brown's Revenue Survey, Doab Canal Office, 14th April, 1841

Names of Villages.	Cultivation including fallow.	Lately thrown out of Cultivation.	Fit for Cultivation and capable of immediate return.	Fit for Cultivation not capable of immediate return.	Barren Sub forest Ravines.	Barren Waste, &c.	Barren ¼ of amount of Waste, fit for Cultivation.	Khyr Forest.	Barren Waste including 22 Acres of Jungle.	Total Acres.	Captain Brown's Remarks.
Hopeton, ...	180	31	4,396	729	439	411	1,708	..	..	7,894	It appears that the lands North of the Sutwala Row in general, may be irrigated from the Jumna by a Canal cut from Domayut.
Anneshpaul, ...	689	..	4,319	21	..	..	1,173	95	859	7,402	The Khadir lands can be irrigated from the Jumna, and amount to 1,610 Acres it also appears to be practicable to irrigate the higher lands from the Jumna, but the excavation would be expensive.
Dhukrani, ...	461	72	1,252	..	..	645	..	..	..	2,480	
Mundi, ...	..	..	71	..	..	49	..	..	..	120	
Rajghat Mundi, ...	5	11	284	..	..	164	..	..	..	464	Ditto
Lakhunwala, ...	259	3	175	..	..	95	..	..	..	532	Ditto.
Futehpoor, ...	314	10	346	..	..	259	..	..	..	929	Ditto
Byragewala, ...	55	..	85	..	..	47	..	..	..	187	Ditto.
Jusoowala, ...	..	..	..	..	..	..	..	..	..	..	,,
Pirtheepoor, ...	78	..	14	..	..	14	..	..	..	106	Ditto.
Gungbewa, ...	57	..	11	..	..	12	..	..	..	80	Ditto.
Grand Total, ...	2,098	127	10,953	750	439	1,740	3,187	95	859	20,254	

I have not been able to procure the return on the Village of Jusoowala, but as the above contains the whole area of the Hopeton West Grant, portion of which is on the East side of the Seetla, or Sutwala Row, the admission of the one will more than cancel the omission of the other. By this there appear to be 17,115 acres of land which may be cultivated, omitting the items in the 5th, 6th, 7th, and 8th columns, the greater portion of which would also become cultivable land.

(Signed) P. T. Cautley, *Captain, Superintendent Doab Canal.*

No. 33.

To G. F. Franco, Esq.
Commissioner, Division of Meerut.

Sir,—I have the honour to acknowledge the receipt of your letter, No. 35, dated 12th July 1841, with its enclosure, and map as per margin,* relative to a Canal proposed to be cut from the river Jumna at Kutta puther, for the purpose of supplying water for drinking and irrigation to a portion of the Dhoon, where it is indispensibly required to secure the settlement of villages, increase of population, and cultivation of some of the finest and richest lands in the western division of the Dhoon, and calling on me for a report on the same.

* Capt. Cautley's letter No. 1883, dated Doab Canal Office, Camp Hurdwar, 29th April 1841.
Estimate No. 38 dated the same office, 14th April 1841.
Return of Village Lands, extracted from Capt. Brown's Survey, dated the same date.

The delay which has occurred in sending my reply, was caused by the uncertainty which existed regarding the quantity of water which would be contracted for by Grantees and Mookuddums falling under its influence, in consequence of the principal grant being in progress of transfer; this arrangement having been brought to a satisfactory conclusion, and the present holders having the means at command of carrying into full effect the intentions of Government in opening the Canal, I have much pleasure in reporting, that I have consulted the wishes of all those whose lands come under the influence of the Canal under consideration, and the desire to have it completed, as soon as possible, is universal, and all are ready to engage for as much water as will irrigate all the lands falling under its influence, which after examination and comparing with Captain Brown's survey, does not appear to be overestimated by Captain Cautley when he reports it to comprise 10,700 acres. A great portion of this land is now waste, overgrown with fine grass, and uninhabited, principally from want of water; these obstacles being removed, there is not a doubt, but villages will spring up and the population will increase.

The full amount of the receipts calculated on by Captain Cautley, may not be realized the first or second year, but they will increase, and lands at present waste will soon become productive, and ultimately yield a considerable revenue to Government, which has not been taken into consideration in Captain Cautley's estimate. Under this impression, I cannot too strongly urge my recommendation of the undertaking being commenced on as soon as circumstances will permit. I have detained the documents stated in the margin, for the purpose of taking a copy of them for registry in my office; when that has been effected, I shall have the honour of returning them.

I have the honor, &c.
(Signed) F. YOUNG, *Lieut. Col.*
Political Agent.

DEYRAH DHOON,
Political Agent's Office,
the 30th October, 1841.

The Commissioner of the Meerut Division, in submitting the Political Agent's report, with his letter No. 433 of the 24th December 1841, observes, Par. 2: "I consider that one lac of Rupees would "be well laid out in the construction of this work, and that it would "yield a sure and early return. The grantees in the Doon are en-"terprising, and will avail themselves immediately of the means of "irrigation afforded, by bringing under tillage the arable land now "lying waste for want of water. Colonel Young's reference to those "who would benefit by the proposed Canal is very satisfactory, and "I know that the grantees are most desirous that the work should be "undertaken."

No. 118.

Canal Office, West of the Jumna, Kurnaul, July 7, 1841.
TO H. M. ELLIOTT, ESQ.
Secretary, Sudder Board of Revenue,
Allahabad.

SIR,—I have the honor to acknowledge the receipt of your letter No. 63 of the 22nd ultimo, enclosing copy of Captain Cautley's report on a proposed water-course from the Jumna in the Deyra Dhoon, on which you do me the favor to ask my opinion.

2. The simplicity of the work proposed, and the known skill and experience of Captain Cautley, leaving no doubt as to the correctness of the estimates, the practicability of the work, or its exact suitable-

ness to the purposes for which it is intended, I suppose that my opinion is merely required on the question mooted in the 14th paragraph of Captain Cautley's report, regarding the expediency of diverting any part of the Jumna water from the supply of the existing Canals.

3. The supply of water in the Dehli Canal has during some months of three several years; (viz. 1836-37, 1837-38, and 1840-41,) fallen considerably short of the demand, and many villages situated near the ends of the Canal branches in the Dehli, Rohtuk, and Hansie districts, have, from this cause, and from the greater consumption of water by those above them, been temporarily deprived of the full means of irrigation they once possessed, nor has the loss been confined to the villages so situated, as it has necessitated vexatious restrictions on the irrigation throughout the whole line of Canals.

4. Under these circumstances, I consider it my duty (both to Government, whose revenue settlements have been made with reference to present means of irrigation, and to the Zemindars, whom I have induced and assisted to dig water-courses,) to deprecate any avoidable diminution of the Jumna water.

5. I am willing to admit that the Doon may probably benefit more from the Kutha Puttur Canal, than the Dehli territory would lose by the abstraction of eighty cubic feet of water per second, and that the whole of the eighty feet so abstracted might not be a dead loss, as some surplus might return via the Satwala and Asun to the Jumna, and a proportion even of that used in irrigation, might, by percolation of the soil, find its way into the natural drains of the country, and eventually return to the parent stream. A deduction may also be claimed for waste by absorption and evaporation, during the transit of the said eighty feet from the Dhoon to the irrigating districts of the Dehli territory. But with respect to the first concession, I submit that the Dehli territory has a prescriptive right to as much of its present means of irrigation as can be maintained, and though I cannot exactly estimate the effects of the latter, I believe that they would be found inconsiderable, and at all events, it is undeniable that some loss would occur, and whether that loss be small or great, the principle remains unaltered.

6. It may be argued, that the loss of the Dehli territory merely results in that of Government, who have the power of compensation by re-

mission of revenue, and that the real question, therefore is, whether the moral and political advantages anticipated from the colonization of the Dhoon are likely to overbalance the partial deterioration of the Dehli territory as a source of revenue, and the proportionate loss of the original outlay on the Dehli Canal. But I consider that the discussion of such questions will not be expected from me, who am merely called upon to state *(ex parte)* in what degree the contemplated measure would affect the particular interests intrusted to me by Government.

7. In conclusion, I beg to acknowledge the courtesy of the Sudder Board of Revenue, in having allowed me an opportunity of bringing forward the above statement.

And have the honor, &c.

(Signed) W. E. Baker,
Superintendent of Canals, West of India.

Extract Pars. 2 to 4 of letter No. 2603, dated 8th February 1842, from Captain F. Abbott, Officiating Superintending Engineer, North-west Provinces.

2. "I much regret that I did not receive the plans of the Kutha Puther water-course, as I could not in consequence, examine the proposed site. I have, however, been over portion of the ground to be watered by this project, and have visited the Jumna, near the proposed head.

3. "Captain P. T. Cautley proposes, I believe, to draw off seventy-five cubic feet per second from the Jumna, for the supply of the Kutha Puther water-course. Of this a portion would return to the Jumna in the shape of tail-water, and a small portion by percolation. I am therefore of opinion, that the diminution of the river's volume, at the heads of the Doab and Dehli Canals, would be imperceptible. It must, however, be noticed, that the whole loss, instead of being divided between the two, would fall exclusively upon the latter, as the Doab Canal has the command of head.

4. "It would appear adviseable, on general principles, to make this small sacrifice upon the Dehli Canals, with the view of fertilizing so large a portion of valuable land as that contemplated by the Kutha Puther project, amounting I believe to 26,000 Beeghas, were measures

taken to ensure the use of its waters; and I think this might be effected by the adoption of the assessment or contract system. But some agreement should, I think, be entered into with the landed proprietors previous to commencing upon the work, to save the State from chance of loss."

No. 160.

To R. N. C. Hamilton, Esq.

Secretary to Government, N. W. Provinces, Agra.

Sir,—In submitting for the consideration and orders of Government, the accompanying correspondence respecting the opening of a new Canal near the village of Kutha Puther, in the Dehra Doon, the Sudder Board of Revenue, N. W. P. observe, that Captain Cautley estimates the expense of the proposed water-course to be, 90,307, and that it will yield 7,000 Rs. per annum, or about 7¾ per cent. the capital sunk.

2d. At the same time it will divert from the channel of the Jumna 75 cubic feet of water per second, of which one-half, it is calculated, will be entirely lost to the volume of the stream at the Doab Canal head. The whole of this water will be abstracted from the Dehli and not from the Doab Canal, the head of the former lying below that of the latter, and the loss will be felt during that portion of the year, when the whole body of the river is used for irrigation through the Canals.

3d. Half the water then which will yield rent through the Kutha Puthur water-course, after an outlay of 90,000 Rupees, would at present yield a higher rate through the Dehli Canal, without any outlay at all.

4th. Hence it seems very questionable whether, viewing the question as a mere profit on the consumption of a certain quantity of water, it would be desirable for the Government to engage in this undertaking.

5th. There are, however, many other questions which might influence the decision, and on these the Board have not the means of decidedly expressing an opinion at present. The Dhoon may perhaps become a most valuable portion of British territory, from the peculiar adaptation of its soil to the more valuable products, and from the fitness of its locality and climate for the enterprize of British capitalists.

Without artificial irrigation of this nature, large tracts of it, and amongst them that which would come under the influence of the Kutha Puthur Canal, cannot be brought under cultivation. Wells cannot be dug, and the difficulty of procuring water even for domestic purposes, renders them uninhabitable. The water in such cases possesses a double value, being used for the support of life, as well as for irrigation, whilst the rapid fall of its course gives it a still further value as the motive power of machinery.

6. It is therefore far from improbable, that other circumstances besides those of a mere profitable return for the water may render the execution of the proposed work deserving the attention of Government, or become an object for private enterprize.

7. Agricultural operations in the Dhoon are still too much in their infancy to enable the Board to speak with confidence on these points, whilst they are also unprovided with results from the experience of the lately opened Beejapore water-course, and the now constructing Rajpore water-course, on which to build any certain calculations of the effects of such works in the peculiar climate and soil of the Dhoon.

8th. The present time is also probably one in which the Government would be reluctant to engage in an expensive undertaking of problematical utility.

9th. These considerations restrain the Board from recommending the work for immediate execution. But they think it of great importance that the scheme should be generally made known, in order that its merits may be fully discussed. They therefore propose, with the sanction of the Government, to print the Plans, and so much of the Correspondence as may tend to throw light on the project, and hope on some future opportunity to be able to bring the subject again forward on better grounds than they at present possess.

I have the honor, &c.

(*Signed*) H. M. ELLIOTT, *Secretary.*

SUDDER BOARD OF REVENUE,
N. W. P. Allahabad, the 1*st April,* 1842.

(True Copies.)

H. M. ELLIOTT, *Secretary.*

Comparison of the Areas of Plane and Spherical Triangles. By Captain SHORTREDE, *1st Assistant, Grand Trigonometrical Survey.*

[N. B.—The first part of the following investigation is taken from Young's Trigonometry, but the formula there deduced

$\cot\frac{1}{2}E = \left\{\frac{\cot\frac{1}{2}a\cot\frac{1}{2}b}{\cos C} + 1\right\}\cot C$, being inconvenient in all cases, and utterly unworkable when $C = 90^\circ$, I have transformed it as follows.]

E being the spherical excess

$$\tan\frac{1}{2}E = \tan\frac{1}{2}(A + B + C - 180^\circ) = -\cot\frac{1}{2}(A + B + C)$$

$$= \frac{\tan\frac{1}{2}C - \cot\frac{1}{2}(A + B)}{1 + \tan\frac{1}{2}C\cot\frac{1}{2}(A + B)}$$

By Napier's analogies, $\cot\frac{1}{2}(A + B) = \frac{\cos\frac{1}{2}(a + b)}{\cos\frac{1}{2}(a - b)}\tan\frac{1}{2}C$ which substituted gives

$$\tan\frac{1}{2}E = \frac{\tan\frac{1}{2}C - \frac{\cos\frac{1}{2}(a + b)}{\cos\frac{1}{2}a - b}\tan\frac{1}{2}C}{1 + \frac{\cos\frac{1}{2}(a + b)}{\cos\frac{1}{2}a - b}\tan^2\frac{1}{2}C}$$

$$= \frac{\left\{\cos\frac{1}{2}(a - b) - \cos\frac{1}{2}(a + b)\right\}\tan\frac{1}{2}C}{\cos\frac{1}{2}(a - b) + \cos\frac{1}{2}(a + b)\tan^2\frac{1}{2}C}$$

$$= \frac{\cos\frac{1}{2}(a - b) - \cos\frac{1}{2}(a + b)}{\cos\frac{1}{2}(a - b)\cot\frac{1}{2}C + \cos\frac{1}{2}(a + b)\tan\frac{1}{2}C}$$

Multiplying the numerator by sin C, and the denominator by its equal $2\sin\frac{1}{2}C\cos\frac{1}{2}C$, we have

$$\tan\frac{1}{2}E = \frac{\cos\frac{1}{2}\left\{\cos\frac{1}{2}(a - b) - \cos\frac{1}{2}(a + b)\right\}\sin C}{2\cos\frac{1}{2}(a - b)\cos^2\frac{1}{2}C + 2\cos\frac{1}{2}(a + b)\sin^2\frac{1}{2}C}$$

and substituting for $\cos\frac{1}{2}(a - b)$ and $\cos\frac{1}{2}(a + b)$, it becomes

$$\tan\frac{1}{2}E = \frac{\sin\frac{1}{2}a\sin\frac{1}{2}b\sin C}{\cos\frac{1}{2}a\cos\frac{1}{2}b + \sin\frac{1}{2}a\sin\frac{1}{2}b(\cos^2\frac{1}{2}C - \sin^2\frac{1}{2}C)}$$

and, because $\cos^2\frac{1}{2}C - \sin^2\frac{1}{2} = \cos C$,

$$\tan\frac{1}{2}E = \frac{\tan\frac{1}{2}a\tan\frac{1}{2}b\sin C}{1 + \tan\frac{1}{2}a\tan\frac{1}{2}b\cos C}.$$

This expression has some analogy to that for the area of a plane triangle, but here, unlike the case of the plane triangle, it is not a matter of indifference whether the contained angle be acute or obtuse. The second term in the denominator is + or — according as $C \angle 90$ or $C \urcorner 90$. Hence the area and excess also of a spherical triangle whose sides are given, is greater or less according as the contained angle is greater or less than 90.

When $C = 90$ the equation becomes simply

$$\tan \tfrac{1}{2} E = \tan \tfrac{1}{2} a \tan \tfrac{1}{2} b\,;$$

and as every spherical triangle by letting fall a perpendicular becomes the sum or difference of two right angled triangles, this expression may be extensively used.

When the second term in the denominator becomes $= 1$, $\tan \frac{1}{2} E = \infty$, whence $\frac{1}{2} E = 90^\circ$ and $E = 180^\circ$.

When the second term exceeds unity, the whole expression becomes $-$, hence $\frac{1}{2} E$ is in the second quadrant, and the excess exceeds 180°.

In order to apply the expression above found to the comparison of the area of the spherical with that of a plane triangle, it may be otherwise written

$$\tan \tfrac{1}{2} E = \tan \tfrac{1}{2} a \tan \tfrac{1}{2} b \sin C \left(\frac{1}{\tan \frac{1}{2} a \tan \frac{1}{2} b \cos C} \right)$$

when the denominator of the term within the parenthesis may be expanded in the usual way.

For $\tan \frac{1}{2} a$ and $\tan \frac{1}{2} b$ substitute their values in arc to radius 1 by the formula

$$\tan \chi = \chi + \tfrac{1}{3} \chi^3 \frac{2}{15} \chi^5 + \frac{17}{315} \chi^7 + \&c.$$

and we have $\tan \frac{1}{2} a \tan \frac{1}{2} b =$

$$\left(\frac{a}{2} + \frac{a^3}{24} + \frac{a^5}{240} + \frac{17\,a^7}{39720} + \&c.\right)\left(\frac{b}{2} + \frac{b^3}{3} + \frac{b^5}{240} + \frac{17\,b^7}{39720}\right)$$

which by actual multiplication becomes

$$\frac{ab}{4} \left\{ 1 + \frac{a^2 + b^2}{12} + \frac{6\,a^4 + 5\,a^2\,b^2 + 6\,b_4}{720} + \frac{136\,a^6 + 63\,a^4\,b^2 + 63\,a^2\,b^4 + 136\,b^6}{40320} + \&c. \right\}$$

This expression and its powers being substituted in the expansion of the original equations gives

$$\tan \frac{E}{2} = \frac{ab}{4} \sin C \left\{ 1 + \frac{a^2 + b^2}{12} + \frac{6a^4 + 5a^2\,b^2 + 6b^4}{720} + \&c. \right\}$$

$$\left\{ 1 - \frac{ab}{4} \cos C \left(1 + \frac{a^2 + b^2}{12} + \&c. \right) + \frac{a^2\,b^2}{16} \cos^2 C \left(1 + \frac{a^2 + b^2}{6} + \&c. \right) \right.$$

$$\left. \frac{a^3\,b^3}{64} \cos^3 C \left(1 + \&c. \right) + \&c. \right\}$$

by actual multiplication and reduction of terms with common factors this becomes

$$\tan\frac{E}{2} = \frac{ab}{4}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C + \frac{6a^4+5a^2b^2+6b^4}{720}\right.$$

$$\left. - \frac{a^3b+ab^3}{24}\cos C + \frac{a^2b^2}{16}\cos^2 C + \&c.\right\}$$

For $\tan\frac{E}{2}$ substitute its value in arc $\frac{E}{2} + \frac{E^3}{24} + \&c.$ and transpose all the terms after the first, then substituting for them their values in powers of the quantity on the right hand side, we shall have

$$\frac{E^3}{24} = \frac{1}{3}\left(\frac{ab}{4}\right)^3 \sin^3 C + \&c. = \frac{ab}{4}\sin C\left(\frac{a^2b^2}{48} - \frac{a^2b^2}{48}\cos^2 C + \&c.\right.$$

incorporating these terms, and multiplying the whole by 2, we have

$$E = \frac{ab}{2}\sin C\left\{1 + \frac{a^2+b^2}{12} - \frac{ab}{4}\cos C\right.$$

$$\left. + \frac{3a^4-5a^2b^2+3b^4}{360} - \frac{a^3b+ab^3}{24}\cos C + \frac{a^2b^2}{12}\cos^2 C + \&c.\right\}$$

The first term is the same as that for the area of a plane triangle having the same sides and contained angle: the following terms therefore shew the difference between the areas of the two triangles. Of these, we may take account of as many as suits our object; but in ordinary cases it will be needless to regard any beyond the two first. Limiting ourselves to these, the difference between the areas of the plane and spherical triangles corresponds to an excess represented by

$$\frac{ab}{2}\sin C\left(\frac{a^2+b^2}{12} - \frac{ab}{4}\cos C\right) \text{ or by } \frac{ab}{24}\sin C\left(a^2+b^2 - 3\,ab\cos C\right)$$

This expression shews that when cos C becomes —, or when C exceeds a right angle, the spherical area must exceed that of the plane triangle. When the two terms within the brackets cancel each other, the two triangles will have equal areas; and when the second term exceeds the first, the spherical area will be less than that of the plane triangle.

The limits are easily assigned.

The sum of a and b being given, $a^2 + b^2$ is a minimum, and $3\,a\,b$ is a maximum when $a = b$. In this case the triangles are isosceles, and $a^2 + b^2 = 2\,a^2$, and $3\,a\,b = 3\,a^2$; hence the terms within the brackets will cancel each other when $\cos C = \frac{2}{3}$ or when $C = 48^\circ\ 11'\cdot 23''$. For equal areas this is the maximum of C. With isosceles triangles, if

C be less than this, the spherical area will be less than that of the plane triangle.

When cos C is a maximum C = O. In this case $a^2 + b^2 = 3\,a\,b$, or $1 + \frac{b^2}{a^2} = 3\frac{b}{a}$; which solved as a quadratic gives $\frac{b}{a} = \frac{3 + \sqrt{5}}{2} =$ 2·618 nearly. This is the maximum inequality in the sides, so as to have equal areas.

In like manner, the value of the angle may be found for any given ratio of the containing sides within these limits; or the angle being given, the ratio of the sides may be found. To save the trouble of these calculations, I have constructed the small table in the margin, which shews for given ratios of *a* and *b* the value of C with which the spherical and plane triangles have equal areas. If the sides were so large in regard to the radius, that the terms omitted could sensibly affect these results, it would be necessary to take into account those of the next, and perhaps also of higher orders.

$\frac{b}{a}$	Cos C	Log cos C	C
1·0	$\frac{200}{300}$	9·82391	48°·11′
1·1	$\frac{221}{330}$	·82588	47·57
1·2	$\frac{244}{360}$	·83109	47·20
1·3	$\frac{269}{390}$	·83869	46·23
1·4	$\frac{296}{420}$	·84804	45·11
1·5	$\frac{325}{450}$	·85067	43·46
1·6	$\frac{356}{480}$	·87021	42·08
1·7	$\frac{389}{510}$	·88238	40·18
1·8	$\frac{424}{540}$	·89498	31·16
1·9	$\frac{461}{570}$	·90783	36·01
2·0	$\frac{500}{600}$	·92082	33·33
2·1	$\frac{541}{630}$	·93386	30·50
2·2	$\frac{584}{660}$	·94687	27·46
2·3	$\frac{629}{690}$	·95980	24·16
2·4	$\frac{676}{720}$	·97262	20·08
2·5	$\frac{725}{750}$	·98528	14·50
2·6	$\frac{776}{780}$	·99777	5·48

To ascertain the actual difference in the areas of the spherical and plane triangles in an extreme case, suppose an equilateral with sides of $1\frac{1}{2}$ degrees: the direct formula gives the excess $= 61''{\cdot}217$; and the difference in the areas of the two triangles will be 0·3951 square miles, corresponding to an excess of $0''{\cdot}005245$: One-third of this would be the error on each angle, and, were it ten times as great, it would still be, in Troughton's phrase, a quantity less than what is visible in the telescope.

It is almost needless to remark that the supposed triangle is larger than any which has yet occurred in practice. The great triangle in the French arc, (long supposed to be the largest in the world), has an excess of about 39″. I have had one observed by day-light on which the excess was about 40″.5. The least side was 80 and the largest 92 miles. Such a triangle does not often occur, but even this had about $\frac{2}{3}$ only of the area of that on which the difference has been shewn to be utterly insensible.

But as the greatest difference occurs when C exceeds a right angle, we may find the particular angle giving a maximum difference of area by making $\frac{a\,b}{24}\left\{(a^2 + b^2)\sin C - 3\,a\,b\sin C\cos C\right\}$ a maximum. By differentiating, we have

$$\frac{ab}{24}\left\{(a_2 + b^2)\cos C - 3\,a\,b\cos 2\,C\right\}d\,C = o$$

whence the maximum corresponds to $\frac{a^2 + b^2}{3\,ab} = \frac{\cos 2\,C}{\cos C}$

This hardly admits of being solved directly, but the indirect solution is very easy.

Since C must be greater than a right angle, we may put $C = 90 + \chi$; whence $\frac{\cos 2\,C}{\cos C} = \frac{\cos 2\,\chi}{\sin\chi}$: and since $\frac{a^2 + b}{3\,ab}$ is always +, it is plain that χ cannot be less than O nor exceed 45°. Hence the quantity $\frac{\cos 2\,\chi}{\sin\chi}$ will pass through all its values from o to ∞ in every half quadrant.

C	$\text{Log}\frac{a^2+b^2}{3\,ab}$	C	$\text{Log}\frac{a^2+b^2}{3\,ab}$	C	$\text{Log}\frac{a^2+b^2}{3\,ab}$
90	+ ∞	105	0·52453	120	0·00000
91	1·75788	106	·48808	121	9·95977
92	·45612	107	·45264	122	·91763
93	·27881	108	·41798	123	·87320
94	·15217	109	·38389	124	·82601
95	·05306	110	0·35020	125	9·77546
96	0·97117	111	·31674	126	·72076
97	·90101	112	·28336	127	·66088
98	·83929	113	·24989	128	·59433
99	·78387	114	·21620	129	·51901
100	·73332	115	0·18212.	130	9·43160
101	0·68657	116	·14750	131	·32661
102	·64285	117	·11217	132	·19372
103	·60157	118	·07595	133	8·00980
104	·56226	119	·03864	134	7·70105
105	·052453	120	0·00000	135	— ∞

By tabulating this, as in the margin, for every degree of χ, we may readily find, for any given ratio of the sides, the approximate angle giving a maximum difference of areas.

By means of this and the former Table, it will appear, that with equal sides the angle of maximum difference of areas is somewhat greater than 124°, and by a nearer computation the exact value of C will be found 124°· 02′·35″, being the greatest angle, giving a maximum difference of areas. For any other ratio of sides the angle will be smaller. For the ratio $\frac{3 + \sqrt{5}}{2}$ the angle is 120°. When the ratio is $\frac{10}{1}$ the value of $\frac{a^2 + b^2}{3\,ab}$ is $\frac{101}{30}$, the log of which 0·52720 corresponds to a value of C somewhat less than 150° or 140°.55′.45″; and so in other cases. When the ratio of the sides becomes indefinitely great, the maximum difference angle approaches indefinitely near to 90°.

In well chosen triangles there is not usually any very great differences in the sides, and hence, practically, the greatest differences of area will usually occur when C is not far from 120°.

If, for example, we suppose a triangle with sides of a degree each, and containing an angle of 120°, by the original formula, the excess is 27″.210; and the difference in area between the spherical and plane triangles is 0·18214 square miles, the excess corresponding to which is 0·0024176. On a triangle with degree sides and the maximum angle 124°.02′.35″, the excess is 26″.035: the difference of areas is 0·18320 square miles, the excess corresponding to which is 0″.0024318. Such differences, though utterly insensible in the telescope, are still much greater than have ever occurred in practice; for though a single side of more than a degree be nothing very extraordinary, it is but rarely that two such sides can be found forming a triangle with a third side of from 118 to 120 miles.

The difference here treated of is, in similar triangles, proportional to the 4th powers of the homologous sides: Hence, in an equilateral with half degree sides, this difference would be $\frac{1}{81}$ of 0″·005245, or 0·00006475; and on the isosceles with half degree side containing 120°, the difference would be $\frac{1}{16}$ of 0″·0024176, or 0″·00001511. Triangles such as these are not very uncommon, but it is much more common to have triangles with less than half of their area.

It is thus fairly proved that the difference between the excess on a spherical triangle computed rigorously and the excess deduced by reckoning its area as equal to that of a plane triangle with the same sides and contained angle, is a quantity so small that, even in extreme cases, the neglect of it will not induce any sensible error; and that, on triangles such as usually occur in practice, the difference is so utterly insignificant that to go much out of the usual way in order to take account of it, would be a very needless refinement.

A Note on CAPT. SHORTREDE'S *Remarks in No. CXXIII. (Page 240) of this Journal. By* S. G. T. HEATLY, *Esq.*

The subjects of geometry are not the creatures of arbitrary definition. We strive first to attain such a definite conception of them as enables us to see how their properties follow from their nature: we enunciate this conception as well as we can in words, and call it the *definition.* But we cannot, however, enunciate the process of intuition by which we are conscious of the necessary consequence of any the most rudimentary property. We are compelled therefore to put down this rudimentary property itself; it is termed an *axiom.* Hence the indispensable appearance of axioms in a system of geometry.

On these grounds I agree entirely with the position that, in mathematical definitions, it is necessary to have a clear conception of the idea, and then to use such words as will convey that conception to the mind of another. It did not appear to me that a clear conception of the idea of an angle is generally entertained; and I endeavoured to analyse the language commonly held on the subject, so as to detect the peculiarity which impressed itself on the minds of various authors, and to shew that the idea of an angle involved the conceptions—of surface—of determinate extension in the direction of width—of indeterminate extension in the direction of longitude. These are conceptions which every one, sooner or later, finds floating in his mind clearly or obscurely, and if they enable the student to perceive distinctly what he is about when he is discussing angles, it is our business to place them before him in the simplest and most direct form.

The use made of the word *direction* arose from the habit of always reducing geometrical magnitudes and positions along fixed axes, the two axes being in this case (I need not say) one bisecting the angle, indicating the direction of length—and one perpendicular to it, indicating the direction of width. This appeared to me necessary to embody distinctly the conceptions intended to be impressed.

To the axiom I cannot conceive any objection raised: it is merely an application of the principles of geometrical equality to angular magnitude. The real "pinch and nip" (to use Colonel Thompson's significant expression) lies in the perception of the truth that whatever applies to an angular space, applies to its angle. This is the elementary property which must be clearly seized: for which purpose we may put it thus: Let the angle and the angular-space be in any ratio, say $a : b$. Then *á dividendo* the angle is to the difference between it and the angular space, a finite rectilineal figure, as $a : a\text{-}b$. But the angle is infinitely greater than the finite rectilineal figure: hence a is infinitely greater than $a—b$, whence the latter is zero, or $a = b$, and the angle = the angular space.

The matter lies in a simple compass: if the angle be not an infinite surface, what is it? If it be, it must be discussed according to its nature. There can be no arbitrary limitations to the province of geometry: if you will adhere to them, you must try to do without angles, for they are interlopers. The Greek confined himself to the geometry of the line and the circle, and did wonders therewith; but the trisection of the angle and the duplication of the cube required him to extend his armory. The Italian (Mascheroni) yet more chivalrous, used only the circle: but his was a tilt-yard exercise. The only oath administered to the candidate for mathematical knighthood is, that he shall seek always for Truth in the realms of Space and Number, and that he will do his devoirs with every lawful weapon of sound logic. The attempt to assign forced and arbitrary limits to things which do not admit of them, has always been productive of mischievous consequences in retarding our onward progress in physics as in legislation, in poetry as in mathematics.

Errata in the Essay on Angular Geometry.

Page 231,	line 16	from bottom,	for Bossat	read Bossut
,, ,,	,, 8	....	,, cerelations	,, correlations
,, 233	,, 1,14	,, top	,, Thomson	,, Thompson
,, 235	,, 9	,, bottom	,, 2 n $\bar{n}$ + A	,, 2 n π + A
,, 236	,, 6	,, top	,, devote	,, denote
,, 237	,,* 17	,, bottom	,, angle	,, angles
,, ,,	,, 13	,, ,,	,, Each of	,, each side of
,, 238	,, 15	,, ,,	,, D E D	,, D E B
,, ,,	,, 9	,, ,,	,, straight cuts	,, straight line cuts
,, ,,	,, 2	,, ,,	,, Fig. 12.	,, Fig. 11
,, 239	,, 3	,, top	,, C	,, A
,, ,,	,, 4	,, ,,	,, Fig. 13	,, Fig. 12

,, This line should run thus: Let A C meeting A B, not meet *its* parallel E D, consequently, &c.

Descriptive Notice of the Bat described as Taphozous longimanus, by Gen. HARDWICKE. *By* EDW. BLYTH, *Curator to the Asiatic Society.*

Upon a former occasion (in vol. X. p. 971 *et seq.*,) I described three Indian species of *Taphozous*, doubtfully identifying one of them with the *T. longimanus*, Hardwicke (*Lin. Trans.* XIV. 525); but I have since obtained a species which I cannot doubt is the animal so named by that naturalist, bringing the number of ascertained Indian species of this genus to four, of which the present is the only one previously known to the publication of my former memoir. It remains, therefore, to impose a distinctive appellation upon the species which I then cited doubtfully as *T. longimanus*, and which I now propose to designate *T. Cantori*, in honour of the accomplished naturalist who favored me with the specimen.

The *T. longimanus* deviates in some particulars from the detailed account which I gave as of generic application, the ears of this species not lying flatly outward—as in the *Rhinopomata* and *Dysopodes*, and as in the recent *T. Cantori*, but remaining suberect, as usual in other *Vespertilionidæ* : hence the measurement of nine-tenths of an inch between them, given by Gen. Hardwicke, is intelligible; whereas in *T. Cantori* I could not recognise it, nor well understand where it had been taken : again, the tail when exserted by the collapse of the interfemoral membrane does not curl round upward, as in *T. Cantori*, nor has any tendency that way, but remains out straight, with but slight capability of bending except at its extreme base : the nostrils do not appear capable of closure, which leads me to doubt whether this be truly the case in the other species. I observe, both in the present species and its congeners, two remarkable characters which may be added to the diagnosis of the genus : viz., the double flexure outward of the extremity of the closed wing, which always collapses in this manner, whereas in other Bats the wing does not naturally so fold, but the tip turns inward; in connexion with which may be mentioned that the first digit in *Taphozous* consists of but one phalanx terminating in a *(quasi)* joint-knob, whilst in most other Bats (*Rhinolophus* appears to be an exception) there is a small second phalanx more or less developed beyond this, and in the Pteropodine group two additional phalanges with a terminal claw (the latter only being absent in *Cephalotes*, Geoff., in which was comprised *Hypodermis*, Is. Geoff.); secondly, the testes, in *Taphozous* (as in *Megaderma*, and I presume *Rhinolophus*), are situate as in man and the monkey tribe, whereas in the restricted *Vespertilio* group they are placed posterior to the anus, and in the Pteropodine section laterally to the penis; this being a character which may help to indicate the primary divisions of the family: the magnitude of the genitals is a remarkable feature of the Vespertilionine subdivision generally, being in some species quite inordinate; but this is not the case in *Taphozous*, wherein the penis wholly withdraws internally. Finally, it may be remarked that the feet and tail of this genus have always a few scattered long and slender hairs; and that the fore-arm is more than usually curved at the basal third.

The specimen of *T. longimanus* before me (an adult male) measures four inches and one-eighth to tail-tip, the membrane extending five-eighths of an inch beyond; expanse fifteen inches and a half, and length of fore-arm two inches and three-eighths; the tail an inch, capable of being wholly sheathed within the membrane, and of protrusion for five-eighths of an inch: ears, measured internally, from base of lowermost lobe, nine-sixteenths of an inch, and externally half an inch: no upper incisors, as likewise in the examples of the three other species described by me: the throat-sac particularly large, measuring three-eighths of an inch wide, and thickly lined with a hard and fœtid exudation; there is also a small circular second cavity, a quarter of an inch posterior to the first, and yielding a similar secretion; this is also perceptible, but rather less developed, in *T. fulvidus*: the fur is close and velvety, of a dark brown colour, slightly grizzled with a pale hue at the tips, and not white at base as in *T. Cantori* (which species has the throat-sac merely rudimentary); beneath it is scarcely paler than above, but the throat is deeply tinged with rufous: membranes brownish-dusky.

The *T. longimanus* is stated by Gen. Hardwicke to be "common in Calcutta, in dark store-rooms; at night it frequents habitations, attracted by the light of the candles and numerous insects." The present specimen was shot in a rural situation, two or three miles from Calcutta; and, I may remark, rather late in the evening, when I had been waiting some little time for an opportunity to discharge my second barrel, prior to returning from a Bat-shooting excursion;

hence, as its stomach was quite empty, I think it probable that the members of this genus do not leave their retreats so early as the ordinary *Vespertiliones;* indeed I have often wondered that, considering the great number of Bats which I have lately shot, I could never thus meet with any not appertaining to the sub-genera of restricted *Vespertilio*, save only the great *Pteropus Edwardsii* and the *Pachysoma marginatum*, both of which are abundant. The Bats that fly round the dinner-table of an evening are oftentimes a little tantalizing to a zoologist, though it is not often he would succeed in catching them if he made the attempt, since the rooms in this part of the world (as the European naturalist may be reminded) are lofty and spacious, with open doors and windows in all directions. Still I must say I cannot think that the *Taphozoi* are frequent visitors.*—Nov. 22d, 1842.

Proceedings of the Asiatic Society.

(Friday evening, 15th July, 1842.)

The Hon'ble W. W. Bird, in the chair.

The following Books were presented.

Books received for the Meeting of the Asiatic Society, on the 15th July, 1842.

The Oriental Christian Spectator, April 1842, Vol. III. No. 4.

The Calcutta Christian Observer, July 1842. Vol. III. No. 31.

The Calcutta Literary Gleaner, 1842, Vol. 1, Nos 3 and 5.

Annual Report of the Transactions of the Bombay Chamber of Commerce, 1840-41.

London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science, Vol. XX, No. 130.

The Annals and Magazine of Natural History, Vol. VIII. No. 54, and Vol. IX. No. 55.

Journal des Savants, Novembre et Decembre, 1841.

Pemberton's Report on Bootan, Calcutta, 1839, from Government.

Macpherson's Report upon the Khonds of the districts of Ganjam and Cuttack, Calcutta, 1842.

Catalogue of the Physiological series of Comparative Anatomy, contained in the Museum of the Royal College of Surgeons in London, 1840, Vol. V.

Summer; or, the causes, appearances, and effects of the Grand Nuptials of Nature, by R. Mudie, London.

Narrative of an Expedition to the Polar Sea, in the years 1820, 1821, 1822, and 1823, by the Baron Von Wranzell, translated by E. Sabine, London, 1840.

Glossarium Archaiologicum: Authore H. Spelmanno, Londoni, 1687.

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* Some annoying typographical errors occur in my former paper on the *Taphozoi*, consequent upon making a slight alteration in the text when correcting the proofs. In vol. x, p. 972, 2nd line, read "*Loret Volant* of Daubenton, styled *Senegalensis* by M. Geoffroy;"—4th line, read—"a fourth is described by M. Geoffroy, as *F. Mauritanus*,"—close of 18th line, read "Raffinesque;"—and at p. 973, line 21, for altitude read "attitude." E. B.

Read letter from J. H. **Batten**, Esq. Almorah, 27th June 1842, reporting that Mr. **Lushington** was sending a magnificent collection of Ores, which would do admirably for the Museum of Economic Geology, and that the continuation of Capt. **Manson's** Journal was just now suspended, because Lieut. **Weller**, Executive Engineer and Junior Assistant to the Commissioner of Kemaoon had lately visited the Juwahir Pass, and among other things, had with his own eyes seen "*millions upon millions of maunds of Ammonites*" on the hills sloping down from the Pass into the valley of the Sutlej, and that he wished to enrich his side notes with Extracts from the Journal of his Correspondent on his return to Almorah.

Read letter from Lieut. A. **Cunningham**, of 18th June 1842.

My dear Torrens, *Lucknow, 18th June*, 1842.

I send you a packet of English Coins to be offered to the Asiatic Society for sale; and a small packet of Roman Coins to be presented to the Museum.

I enclose a list of the English Coins, silver and copper, with their prices. They form a small collection; but amongst them, are some rather scarce Coins.

I have a fine Sassanian collection to dispose of, which perhaps the Society might like to take. If so, kindly let me know, and I will make out a list, with the prices of the Coins attached.

Believe me,
Most sincerely yours,
Alex. Cunningham.

LIST OF ENGLISH COINS.

Nos.	*Silver.*	*Denomination.*	*Value.*			
1.	Edward 4th	groat,	5	0	0	
1.	Elizabeth,	shilling,	1	0	0	
1.	Ditto,	six pence,	2	0	0	
2.	Ditto,	pennies,	2	0	0	
1.	Ditto,	half penny,	5	0	0	
1.	James 1st,	six pence,	1	0	0	
1.	Ditto,	penny,	1	0	0	
1.	Charles 1st,	shilling,	5	0	0	
1.	Ditto,	six pence,	2	0	0	
1.	Ditto,	two pence,	1	0	0	
1.	Commonwealth,	two pence,	5	0	0	
2.	Charles 2nd,	three pence,	1	0	0	
1.	Ditto,	three pence,	5	0	0	by Simon.
1.	Ditto,	two pence,	0	8	0	
+ 1.	William 3rd,	half crown,	2	0	0	
1.	Ditto,	four pence,	0	8	0	
1.	Ditto,	three pence,	0	8	0	
1.	Anne,	four pence,	0	8	0	
4.	George 2nd,	six pence,	2	0	0	
1.	Ditto,	three pence,	0	8	0	
1.	Ditto,	two pence,	0	8	0	
1.	George 3rd,	shilling,	4	0	0	
2.	Ditto,	six pence,	1	0	0	
1.	Ditto,	four pence,	0	8	0	
3.	Ditto,	three pence,	1	0	0	
1.	Ditto,	penny,	0	8	0	
+ 1.	William and Mary,	shilling,	1	0	0	
1.	Ditto,	two pence,	1	0	0	
37.			52	0	0	
	Copper.					
	James 1st,	small coins,	2	0	0	
1.	Charles 2nd,	farthing,	0	8	0	
1.	Anne,	token	1	0	0	
2.	William and Mary,	farthings,	0	4	0	
2.	George 2nd,	farthings,	0	4	0	
			4	0	0	

Totl, 52 + 4 = 56 Rupe

It was ordered, that the English Coins offered; be purchased, and that the thanks of the Society be communicated to Lieut. CUNNINGHAM, for his presentation of the Roman Coins.

Read letter from H. M. ELLIOT, Esq. Secretary Sudder Board of Revenue at Allahabad, dated the 29th June last, forwarding selections from correspondence respecting the proposed formation of a Canal for irrigation to be supplied from the River Jumna, near the village of Kuttha Putthur in the Deyrah Doon.

Referred to the Secretary for publication in his Journal.

Read letter of 30th June last, from R. H. MYTTON, Esq. Magistrate 24-Pergunnahs, requesting return of some Coins found by a convict, or their value Co.'s. Rs. 36.

Ordered, that the Coins be purchased for the Society, and their value forwarded to Mr. MYTTON.

Read the following Report from the Curator:—

SIR,—In the class of Mammalia, I have nothing of particular interest on which to report. We continue to receive such animals as are entrapped or shot at the Botanic Garden, which are always acceptable for exchange or transmission elsewhere; and I have especially to thank Mr. Jos. De Cruz of that establishment, for his kind attention to my wishes in this respect.

In that of Birds, our acquisitions, since the last meeting, have been very extensive.

1. From B. H. Hodgson, Esq., British Resident at the Court of Nepâl, I have the gratification to announce the arrival, as a donation to the Society, of 270 species of birds, whereof four specimens respectively are sent of the greater number (though it is to be regretted that many are in very imperfect condition); and there are seventy species which are new to the Museum, while above 100 are more or less common in this neighbourhood.

2. Mr. Frith has forwarded to the Society specimens of

Budytes citreola, or, I rather suspect, an allied species which is also met with in this neighbourhood.

Esacus recurvirostris, Lesson (1831): *Pseudops* (olim *Carvanica*) *grisea*, HODGSON, *J. A. S.* V, 776; *Œdicnemus recurvirostris*, Swainson.

Rhynchops flavirostris.

3. Mr. Mackay has kindly permitted me to select from a very interesting collection of Malayan birds received from Singapore, examples of such species as are wanting to the Museum, for which I have given duplicate specimens in exchange; and Dr. Spry has also favored me with a like permission in the instance of another collection of Malayan birds, for which I have also looked out a somewhat extensive series of duplicates for transmission to the Cornish institution at Truro. Our acquisitions in this manner consist of the following species, of which those new to the Museum are marked with an asterisk.

Palæornis Malaccensis, Vigors. *Psittacus Malaccensis*, Gmelin, but not of Latham, which refers to the next species. A more beautiful specimen than I remember to have seen before. Middle tail-feathers eleven inches and a half long, and uniform bright purple; the collar between the black moustache and the emerald cap of the finest peach-blossom hue, heightened on the nape (like the crown of *P. Bengalensis)* with a cœrulean bloom; and the rest of the colours exquisitely brought out.

**Psittinus* (Nobis) *Malaccensis: Psittacus Malaccensis*, Latham, but not of Gmelin; *le petit Perruche de Malacca*, Sonnerat. This bird cannot be arranged in *Psittacula* of Kuhl, where generally located, if *P. galgulus* is to be regarded as typical of that division; but, though having a short tail, the rest of its structure places it in immediate proximity with *Palæornis*, while a further token of this affinity exists in the maronne wing-spot, seen also in *Pal. Alexandrinus, schisticeps*, and *Bengalensis*. The allied *Ps. setarius* of Temminck, an inhabitant of Borneo, presents an additional approximation to *Palæornis* in having its two middle tail-feathers much elongated beyond the rest, though remarkable for being partly naked-shafted. I add a description of the specimen before me. Length nearly seven inches, of wing four inches and three quarters, and tail an inch and seven-eighths, the three first primaries being equal and pointed *(as in Palæornis)*, and reaching to the end of the short tail, which latter consists of somewhat narrow feathers resembling those of *Palæornis*, even though not elongated, the outermost being but a quarter of an inch shorter than the middle ones. Beak coloured as in *Palæornis* generally, or having the upper mandible bright coral-red with a white tip, and the under one dusky; its form precisely as in that genus. Crown, rump, and upper tail-coverts, bright purplish smalt-blue, passing on the crown into the greyish-dusky colour of the back; under-parts dull yellowish-olivaceous, the mesial portion tinged with brownish-ruddy: lower tail-coverts yellowish-green tipped with blue; and tibial plumes mingled blue and green: uropygials deep green, and the rest of the tail-feathers yellow, more or less green-edged: wings deep green, margined with yellowish on the coverts, except those of the primaries which are wholly purple: maronne wing-spot before noticed; and the coverts underneath the wing are brilliant crimson, as are also the axillaries, which must shew to advantage as the bird is flying overhead, and induce the expectation that the species is much handsomer than it proves on closer examination.

Ierax cœrulescens, Vigors. I am now acquainted with three species of these very diminutive Falcons, viz. in addition to the present one,—*I. erythrogenys*, Vigors, *P. Z. S.* 1831, 76, (from Canton,)—and a Nepâlese species, rather larger than the others, contained among the specimens sent by Mr. Hodgson, and which is the *Falco Bengalensis* of the old authors, currently but erroneously identified with *I. cœrulescens.**

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* A live specimen of *I. cœrulescens* has lately been received by Dr. M'Clelland from Assam; and the aspect of the living bird gives the idea of a larger species than would be supposed from examination of preserved skins, as it puffs up its feathers much, in a manner which can only be successfully imitated when mounting a recent specimen.

It is not generally known that these tiny Falcons are trained for hawking in the Upper Provinces of India, being flown at Quails and other game of corresponding size, as I have been informed by different eye-witnesses of the sport, which is thus described in Capt. Mundy's 'Sketches of a Tour in India,' II, 25. "We had also some amusing sport with another kind of Falcon, a very small bird, perhaps barely so large as a Thrush, and its prey was proportioned to its strength. It is flown at Quails, Sparrows, and others of the feathored tribe, of like calibre. The mode of starting it is different from that used with any other hawk. The falconer holds the little,

**Ceyx tridactyla*, Lacepede; the so called first variety described in Shaw's Zoology,' Vol. VIII, pt. II, 104.

Bucco gularis, Temminck.

Picus mentalis, Temminck, — not of Jerdon, *Madr. Jl.* Vol. XI, 214, which is *P. Nipalensis* of Hardwicke and Gray, badly figured in their 'Illustrations of Indian Zoology.'

**Cuculus (Pseudornis*, Hodgson,*) lugubris*, Horsfield, *Lin. Trans.* XIII, pt I, p. 179, and figured in the 'Zoological Researches in Java' of the same naturalist: *C. albopunctulatus*, Drapiez, *Dict. Class. d'Hist. Nat.*, Art. *Coucou.* A rare species in collections, and nearly allied to the *Pseudornis dicruroides*, Hodgson, *J. A. S.* VIII, 136.

**Rhinortha* (Vigors,—*Anadœnus*, Swainson,) *chlorophæa; Cuculus chlorophæus*, Raffles, *Lin. Trans.* XIII, pt. II, p. 288.

Eurylaimus Sumatranus, Raffles: *Eu. Corydon*, Temminck.

Eu. ochromalus, Raffles: particularly fine.

Calyptomena viridis, Raffles: male and female.

Irena puella, Horsfield*:* female.

Vanga cristata, Vieillot.

Edolius balicassius verus, adult and young : *E. affinis*, Nobis, Vol. XI, p. 174. I doubt whether this species occurs in India, being replaced here by *E. Fingah*, v. *albirictus*, Hodgson, which is the Indian *balicassius*, Auctorum. I append a Monograph of the Asiatic species of this genus at the close of the present report.

Lanius strigatus, Eyton, *P. Z. S.* 1839, p. 103. Four specimens, all in the obviously immature livery described by Mr. Eyton, and also by myself. (Vol. XI, p. 203).

**Tephrodornis sylvicola*, Jerdon, *Madr. Jl.* No. XXV, 237. This bird appears also to be very common in the Tenasserim provinces.

Muscipeta atriceps, Nobis, Vol. XI, p. 203. The fully mature male of this species has the dorsal region very rich deep ferruginous-bay, with a fine purplish gloss, and all the colours more intense than in the specimen formerly described by me. *

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well-drilled savage within the grasp of his hand, the head and tail protruding at either opening, and the plumage carefully smoothed down. When he arrives within twenty or thirty yards of the quarry, the sportsman throws his hawk much as he would a cricket-ball, in the direction of it. The little creature gains his wings in an instant, and strikes his game after the manner of the *Bhause* [Goshawk.]

"There is a queer tribe of gregarious little birds, common in India, which afford very laughable sport with the above mentioned hawk. They are usually found in a chattering fluttering congress of ten or a dozen, at the foot of some baubul tree; where the little busy-bodies are so absorbed in the subject under immediate agitation, that the falconer may approach within six paces of their noisy court of parliament ere they entertain a thought of proroguing it [*Malacocercus* ——— is probably the species meant]. In the heat of debate, down comes the little Hawk (like some Cromwell) into the midst of the astonished assembly, and begins to lay about him right and left; when strange to say, the whole tribe set upon him, *unguibus et rostris*, and with a virulence of tongue as manifestly vituperative, as if it were couched in words. In the dust of the contest, the sportsman runs up, and all the party take wing, except two or three unfortunates, who, having caught a tartar, lie fluttering in the clutches of the feathered tyrant."

* I have now reason to believe that the latter is a female, whilst the specimen formerly described as female is certainly distinct, and may be designated *M. plumosa.* I shall therefore redescribe the two as follow :—

M. atriceps, Nobis. Length seven inches and upwards, of wing three inches and three-eighths, and tail two inches and five-eighths, bill to forehead (through the feathers) three-quarters

**Muscicapa hirundinacea*, Reinwardt, figured in Horsfield's 'Zoological Researches in Java,' and described by the same naturalist as *M. obscura* in *Lin. Trans.* XIII, pt. I. 146; erroneously identified by Mr. Jerdon with *M. picata* of Sykes, (not of Swainson,) from which it is readily distinguished by having no white on the wings, nor on the exterior border of its outermost tail-feathers, while the bill is also fully a third longer. Inhabits also Tenasserim.

**M. latirostris*, Raffles, *Lin. Trans.* XIII, pt. II, 312, and again so termed by Swainson, *Nat. Libr.*, *Flycatchers*, p. 253: distinct from *M. Poonensis* of Sykes, with which it was suspected to be identical by Mr. Jerdon. I presume this to be the species here indicated, as it differs only from Mr. Swainson's description by having the 4th primary above one-eighth of an inch shorter than the 2nd, whereas the latter is stated by that author to be only as long as the 6th; whence it may be that the feather in question was not fully grown in his specimen. The species there also described by the same author as *M. leucura* (so also named in Latham's 'General History,' though described as new by Mr. Swainson,) is extremely common in Bengal during the cool season; but the same specific name was bestowed by Gmelin upon another species, which should retain it, the more especially as the present one, *i. e.* the male of it, becomes, with full maturity, the *Saxicola rubeculoides* of Sykes, *P. Z. S.* 1832, 92, as first suggested to me by Mr. Jerdon.* Lastly, I may remark that the *M. picata*, Swainson, of Western Africa, described by him in the same place, yields precedence to the Indian *M. picata* of Sykes, and must therefore receive another appellation. I add a description of the skin before me of *M. latirostris*. Length four inches and seven-eighths, of wing two inches and three-quarters, and tail an inch and three-quarters; bill to forehead (through the feathers) half an inch, and three-quarters of an inch to gape; tarse half an inch, and slender. The hue of the upper-parts is darker than in *M. grisola*, being also slightly deeper on the crown; wing-coverts and tertiaries margined with dull fulvous: throat, gorget, belly and under tail-coverts, white, with a slight fulvous tinge on the former; the breast and flanks dull ashy

of an inch and upwards, and tarse somewhat exceeding half an inch. Crown and nape, of the (presumed) male, black with a bright steel gloss; the sides of the head, neck, and breast dark ashy passing into slightly glossed blackish on the throat, and into white on the belly and under tail-coverts: the rest of the upper-parts dark rufo-ferruginous, with a purplish gloss on the back, scapularies, and smaller wing-coverts; the rest of the wing dusky, more or less edged with ferruginous, and broadly so on each side of the tertiaries: bill light horn-colour; and feet apparently plumbeous. The (presumed) female has the colours generally weaker, the glossed tips of the coronal and nape feathers less developed, and no rich purplish gloss upon the back, which is of a dingy and much lighter ferruginous: the under-parts scarcely differ from those of the preceding.

M. plumosa, Nobis. Length (of a supposed female) about six inches and three-quarters, of wing three inches and a quarter, and tail two inches and five-eighths; bill to forehead (through the feathers) nearly seven-eighths of an inch, and tarse five-eighths of an inch. Body plumage very much longer and looser in texture than in the preceding, especially the feathers of the rump, which are of remarkable length and puffy. Upper-parts light olive-brown, tinged with greenish-ash on the crown and ear-coverts; throat and breast pale rufescent, still lighter and passing into white on the belly; wings and tail bright rufo-ferruginous, except the smallest coverts of the former which are hidden by the scapularies, and the primaries and their coverts which are edged with the same colour as the back. Bill pale horn-colour; and feet appear to have been greenish.

* This bird falls under the division *Dimorpha* (olim *Siphya*), Hodgson, *Ind. Rev.* I. (1839), p. 651.

brown, as also the front of the neck contiguous to the ear-coverts, where but a narrow mesial line of fulvous-white passes from the throat to the gorget; bend of the wing beneath, and axillaries, pale fulvous brown; a whitish streak from the nostril to the eye; and bill horny-black, with the basal half of the lower mandible yellow; the latter is broad at base, and evenly attenuating; and the feet apparently are lead-coloured.

Pycnonotus (Kuhl) *melanocephalus: Lanius melanocephalus,* Gmelin; *Turdoides atriceps,* Temminck: not *Brachypus melanocephalus* of Hardwicke and Gray, which I followed in so designating—Vol. XI, p. 168, where I identified with it the *Vanga flaviventris,* Tickell, *J. A. S.* II, 573, though it is far enough removed from a typical *Vanga.* The present is clearly enough the species referred to *Turdoides atriceps,* Tem. *Pl. Col.* t. 147, in Griffith's 'Animal Kingdom,' VI, 389, and again in 'Shaw's Zoology,' VII, 330; but as both descriptions are brief and defective, I subjoin the following. Length six inches and a quarter, of wing two inches and seven-eighths, and tail, which is considerably rounded, two inches and a half, its outermost feather being above three-eighths of an inch shorter: bill to forehead (through the feathers) nine-sixteenths of an inch, and to gape three-quarters of an inch: tarse barely half an inch. General colour olive-green, brightening to yellow on the upper and under tail-coverts, belly and flanks: the whole head and throat glossy black: primaries and inner webs of the tertiaries dusky-black, as also the other wing-feathers interiorly; and tail greenish for the basal two-thirds, then dusky-black, and tipped with yellow more developed on its lateral feathers. The irides are in this genus, usually, if not always, crimson. A young specimen is rather smaller in all its dimensions, but scarcely less bright in colouring, except on the head and throat, where the black is merely indicated. In both, the plumage of the rump is black at base, broadly margined with yellow, as in certain allied species.

P. (?) cyaniventris, Nobis. Length six inches and a quarter, of wing three inches and one-eighth, and tail two inches and seven-eighths; bill to forehead (through the feathers) nearly five-eighths of an inch, and to gape eleven-sixteenths of an inch; tarse half an inch. Colour of the upper-parts uniform yellowish olive-green; the head, neck, and under-parts uniform dark bluish ash-colour, bordering on plumbeous, except the lower tail-coverts which are bright yellow, as are also the edges of the wings anteriorly: primaries dusky, together with the inner and terminal portions of the caudal feathers. Bill dusky, and legs lead-coloured. I place this bird provisionally in this genus, though far from satisfied of the propriety of so doing. As compared with the preceding species, the bill is more Thrush-like, though small; the nostrils very different; the gape furnished with much smaller and less conspicuous setæ; the tail even, or all but so; and the claws less minute; the *ensemble,* in a word, is different; though the technical characters sufficiently apply.

**Chloropsis Malabaricus:* adult and young.

**Parus Sumatranus (?); Melanochlora Sumatrana (?),* Lesson, as quoted by Mr. G. R. Gray ('List of the Genera of Birds, with their Synonymes,' 1st edit., p. 23), who, doubtfully identifying with it the *P. flavocristatus,* Lafr., v. (apud Horsfield) *P. sultaneus,* Hodgson, I think there can be little doubt that the bird now before me is referred to. This only differs from *P. sultaneus* in its inferior size, and in the rounded form of the crest, which does not consist, as in the other, of pointed feathers. Length seven inches and a quarter, or probably as much as eight inches in the recent specimen; of wing four inches; and tail three inches and a half: bill to forehead (through the feathers) nearly five-eighths of an inch, and to gape three-quarters of an inch; tarse three-quarters of an inch. Colour of the upper-parts, wings, and tail, throat, neck, and breast, deep black, without the green shine of *P. sultaneus:* and top of the head, belly and lower tail-coverts, brilliant yellow, the coronal feathers lengthened but rounded. Bill black, and feet bluish lead colour. Possibly enough, this may yet prove to be the *P. flavocristatus* of M. Lafresnoy, rather than Mr. Hodgson's *P. sultaneus.*

* *Timalia pectoralis*, Nobis. Beak nearly resembling that of *T. pileata*, Horsfield, but longer, less laterally compressed, and not quite so deep. Length about six inches and a half, of wing three inches and a quarter, and tail three inches, the latter scarcely rounded, but the outermost feather five-sixteenths of an inch shorter than the next, which again does not quite equal the others; bill to forehead (through the feathers,) three-quarters of an inch, and to gape fifteen-sixteenths of an inch; tarse an inch: colour of the upper-parts, to the rump, olivaceous, the coronal feathers darker along their centres; throat black, and feathers of the fore-neck and breast also black, but each elegantly and conspicuously margined with white: rump, upper tail-coverts, and basal margins of the *rectrices*, bright rufo-ferruginous, the rest of the tail-feathers reddish-brown, tipped and slightly edged with rufous; flanks olivaceous; the lower tail-coverts ruddy: bill dusky-black, the lower mandible whitish underneath; and feet leaden-dusky. A supposed female is rather smaller in all its dimensions, with the breast-markings less developed.

* *T. erythronotus*, Nobis. Bill as in last, but rather less elongated. Length six inches to six and three-eighths, of wing two inches and a half to two and three-quarters, and tail two inches and a quarter to two inches and a half; bill to forehead (through the feathers) eleven-sixteenths of an inch, and to gape seven-eighths of an inch; tarse seven eighths of an inch. Colour of the upper-parts deep rufo-ferruginous; the forehead black, with whitish lateral margins to the feathers, imparting a striated appearance; crown and back of the neck dull rufous-brown, passing into the ferruginous of the back and wings; and sides of the neck, with the under-parts from the breast, dark fuscous-ashy; throat and breast black, the bordering feathers of the latter having a subterminal narrow white bar; above the eye also black, and a small white line passing from the eye backward; likewise a white moustachial patch near the base of the lower mandible: tail much graduated, and, with the primaries, dusky edged with rufous; the lower tail-coverts dark faintly rufous brown: bill black, white at base of lower mandible; and feet dusky-leaden.

* *T. striata*, Nobis. A small species, with proportionally shorter bill than in the preceding. Length five inches and a half, of wing two inches and a half to two and five-eighths, and tail two inches, the outermost feather three-eighths of an inch shorter; bill to forehead (through the feathers,) nearly five-eighths of an inch, and to gape almost seven-eighths of an inch; tarse three-fourths of an inch. Head and neck above black, or rather brown-black, the feathers of the mesial line white about the shaft, forming a streak of this colour along the middle of the head, besides which are two slight lateral streaks not observable in every specimen, in addition to a superciliary line of the same: on the nape the white centres of the feathers broaden and are

more irregularly disposed, while on the back they become much narrower again, more or less so in different specimens, and wholly disappear on the rump; the ground-hue of the back and rump is rich fulvous-brown, brightening on the latter, and tending to rufous on the upper tail-coverts: lores conspicuously pale fulvous, and the throat and foreneck fulvous-white, the ear-coverts margined with black; sides of the breast white, handsomely bordered with black, and a very slight margin of the same to the medial pectoral feathers; rest of the under-parts white, the flanks bordered with fulvous-brown, which spreads nearly over the whole feather posteriorly; lower tail-coverts more or less tinged with the same; wing-feathers dusky interiorly, the coverts having terminal longitudinal white spots; and tail ruddy-brown, margined with more rufous brown at base: bill black, and legs (in the dry specimen) yellowish-white.

* *T. erythroptera,* Nobis. Another small species, with bill very like those of some of the small Soras or Water-crakes. Length five inches and a quarter, of wing two inches and a quarter, and tail two inches, its outermost feathers three-quarters of an inch shorter than the middle ones; bill to forehead above five-eighths of an inch, and to gape three-quarters of an inch; tarse a little exceeding three-quarters of an inch. Upper-parts rufous olive-brown, darker on the head, the wings bright rufo-ferruginous; fore-head, sides of head, throat, fore-neck, and breast, ash-colour, becoming paler towards the belly; flanks pale fulvous-brown, bill dusky, and legs apparently yellowish.

T. gularis, Horsfield; figured in the 'Zoological Researches in Java': *Prinia pileata,* Nobis, Vol. XI, p. 204. The difference in the bill from *T. pileata* is so remarkable, that I hope I may be pardoned for not formerly looking among the described species of *Timalia* for this species, which Dr. Horsfield described from a Sumatran specimen, and I have now seen from the Malay peninsula and Tenasserim. The *T. pileata,* discovered by Dr. Horsfield in Java, was met with by Dr. McClelland in Assam, and the Society's Museum contains a specimen of it from Upper Bengal; this bird is also included in Major Franklin's Catalogue.

T. chloris*; *Iora chloris,* Hodgson, *M. S.: probably *Motacilla rubicapilla,* Tickell, *J. A. S.* II. 576, though the description there applies equally to this and the preceding nearly allied species. It differs from *T. gularis* by having the upper-parts pale olive-green instead of brown, the rusty cap much paler and less spread, and the gular streaks are fewer and narrower. Length about five inches, of wing two inches and three-eighths, and tail two inches, its outermost feather but a quarter of an inch shorter, which is less than in *T. gularis;* bill to forehead five-eighths of an inch, and to gape nearly three-quarters of an inch; tarse five-eighths of an inch. The yellow tinge to the breast is, in some specimens, scarcely less deep than *T. gularis,* whilst in others it is scarcely discernible: bill and feet pale. Lieut. Tickell writes, of his *M. rubicapilla,*—"Female: five inches, eyes reddish-hazel; bill and legs pale horn. * * * Found in the thick underwood, hollows, ravines, &c. is lively and agile, with a frequent piping note and occasional chatter." *List of Birds collected in the Jungles of Borabhúm and Dhulbhúm.* I notice this species here for the convenience of describing it along with its congeners. It is comprised among the specimens presented to the Museum by Mr. Hodgson.*

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* Mr. Hodgson has since proposed the subdivisional name *Mixornis* for this bird, and the preceding species ranks with it.

* *Macronous ptilosus*, Jardine and Selby, *Ill. Orn.* pl. CL. : *Timalia trichorrhos*, Temminck, *Pl. Col.* 594, fig. 1, apud G. R. Gray. Length six inches and upwards, of wing two inches and five-eighths, and tail two inches and a half, the latter broad and much graduated, its outermost feathers being an inch shorter than the middle ones: bill to forehead above five-eighths of an inch, and to gape nearly seven-eighths of an inch: tarse seven-eighths of an inch. The extraordinary character of this species consists in the curious form of the feathers of its flanks and rump, which on the latter, in fine specimens, are two inches and a half in length, being very numerous and dense, and consisting of long and flexible flattened stems, conspicuously white, and scantily fringed with fine discomposed and lengthened hair-like barbs, of a dark colour. The crown is bright rufo-ferruginous; throat black; back and breast deep tawny olive-brown, darker on the wings, and more dusky towards the flanks; and the tail is uniform dusky-black: bill black, and legs dusky probably tinged with lead-colour. This bird is barely separable from *Timalia*, but has the bill less laterally compressed.

Trichastoma, Nobis; n. g. Also nearly allied to *Timalia*, but having a moderately stout Warbler's bill, and very long slender setæ at the gape, affording a ready distinguishing character.

* *Tr. rostratum*, Nobis. Length above six inches, of wing two inches and three-quarters, and tail two inches, its outermost feathers three-eighths of an inch shorter than the middle ones; bill to forehead (through the feathers) above three-quarters of an inch, and fifteen-sixteenths of an inch to gape; tarse fifteen-sixteenths of an inch; middle toe and claw seven-eighths of an inch, and hind toe and claw nearly three-quarters of an inch. Colour of the upper parts uniform olive-brown, somewhat darker on the crown, and having a slight ruddy tinge on the rump and tail; whole under-parts pure white, a little sullied on the breast and lower tail-coverts; lores and sides of the head pale fulvescent-brown, and sides of the neck to the breast ashy: upper mandible horny-black, the lower yellowish-white except at its extreme tip; and legs deeply tinged with yellowish-brown.

* *Tr. affine*, Nobis. So like the other in plumage as to cause some doubt, on a first view, whether it be specifically distinct; but the much smaller size, and different

colour, of the legs and feet, and also the much shorter bill, have decided me to adopt the present course with it. Length five inches and three-quarters, of wing two inches and five-eighths, and tail two inches and a half, its outermost feather nearly five-eighths of an inch shorter than the middle ones; bill to forehead (through the feathers,) not five-eighths of an inch, and nearly thirteen-sixteenths of an inch to gape; tarse three-quarters of an inch; middle toe and claw under eleven-sixteenths of an inch, and hind toe and claw rather more than half an inch. General colour rather paler than in the preceding, excepting on the head; the nape much paler; and rump inclining to fulvous more than rufous: tail and its coverts brighter rufous than in the other; and breast crossed with pale fuscous. Bill wholly pale, and legs appear to have been green.[*]

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* The same indefatigable naturalist has described *T. Nipalensis* and *T. pellotis*, H., *As. Res.* XIX, 182; neither of which I have seen. There is also a Javanese *T. thoracica*, v. *Pitta thoracica*, Temminck, *Pl. Col.* t. 76, which is referred to the present genus in Griffith's 'Animal Kingdom," VI, 402, being described as "olivaceous brown above; underneath testaceous-grey; narrow white band from base of bill passes over the eye." Several species from the Indian peninsula have also been described by Messrs. Franklin, Sykes, and Jerdon; but the greater number of these constitute the distinct group *Malacocercus*, Swainson. The following must, however, be excepted.—*T. hyperythra*, Franklin, *P. Z. S.* 1831, p. 118, described as follows: — "*T. suprà olivascenti-brunnea; capite in fronte corporeque toto subtùs rufis; caudâ supernè fusco obsolete fasciatâ; rostro pallido. Longitudo* 5." The specimen sent to the Society by Mr. Jerdon for this species is rather larger, and has the throat and upper-part of the fore-neck conspicuously white; the frontal plumes merely rufescent-brown, and very rigid, as are in a less degree those of the crown, which it is evident are usually raised, while those of the forehead would at all times stand up forming a sort of crest, somewhat as in *Pastor cristatellus*. Though referrible in preference to *Timalia*, this species is little else than a miniature of the *Malacocerci*.—*T. hypoleuca*, Franklin, *loc. cit.*

**Goldana* (G. R. Gray) *nigrocapitata; Brachypteryx*[†] *nigrocapitata*, Eyton, *P. Z. S.* 1839, p. 103,—distinct from *Br. atriceps* of Jerdon. Length six inches and a quarter to six and a half, of wing two inches and five-eighths, and tail the same, its outermost feather five-eighths of an inch shorter than the middle ones; bill to forehead (through the feathers) eleven-sixteenths of an inch, and to gape seven-eighths of an inch; tarse an inch and one-eighth. General hue of the upper parts rufous-brown, of the under bright ferruginous: throat white, flanked by a black streak: cap black, bordered by a white superciliary streak and loral feathers; ear-coverts dusky, minutely lineated with white and posteriorly with rufous: sides of the head ashy; bill horny-black above, the lower mandible yellowish-white; and legs brown.

**Oriolus castanopterus*, Nobis. A typical Oriole of small dimensions. Specimen apparently female, or perhaps young male. Length about eight inches, of wing four inches and a quarter, and tail two inches and one-eighth; bill to forehead seven-eighths of an inch, and to gape an inch; tarse three-quarters of an inch. Plumage ge-

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identical with *T. Horsfieldi*, Jardine and Selby, *Ill. Orn.* pl. CXIX: vide *J. A. S.* XI, p. 199. Rather a peculiar species, with not a little of the form and aspect of *Calamophilus.* — *T. platyura*, Jerdon, *Supplement.* "Plumage above dark olive-brown, beneath ochry-yellowish; bill yellow-horny; legs fleshy yellow; irides yellowish-brown: tail-feathers obsoletely barred, very broad; 1st and 2nd quills graduated, 4th longest, 3rd and 5th equal. Length five inches and a quarter; wing two inches and a half; tail two inches and a half; tarsus nine-tenths; bill at front four-tenths; at gape six-tenths: bill much compressed; plumage very lax. I was at first," continues Mr. Jerdon, "inclined to take this little bird for a *Warbler*, but a review of all its characters has induced me for the present to place it among the *Timaliæ*. I procured a specimen in long reedy grass at Goodaloor at the foot of the Neilghierries. It took short flights and endeavoured to conceal itself among the thick reeds. Its food consisted of insects." Possibly a member of my new genus *Trichastoma* described in the text, as is decidedly Mr. Jerdon's *Timalia poiocephala*, which he has sent me. (Vide *Addendum* introduced at the close of *Appendix*, No. 2, of the present Report.)

[*] A third species of this group exists in the *Timalia poiocephala* of Mr. Jerdon's *Supplement*, which has a good deal the aspect of a *Curruca*, and likewise considerably resembles the *Hemiparus* (olim *Siva*) *Nipalensis*, Hodgson, *Ind. Rev.*, 1838, p. 89, but is readily distinguished from it by the rufescent hue of its under-parts, the length of the rictorial vibrissæ, and absence of any dark line over and beyond the eye. Length six inches, or nearly so; of wi[illegible] two inches and five-eighths, and tail two inches and a half; bill to forehead (through the feathers) above half an inch, and three-quarters of an inch to gape; tarse seven-eighths of an inch. Head and neck dull cinereous, the body greenish olive-brown, inclining to tawney on the rump, wings, and tail; beneath light rufescent-brown, the rufous tinge increasing on the belly, and lower tail-coverts dull tawney. Bill dusky above, yellowish at the edges and tip; "legs pale fleshy; and irides white. I procured a single specimen of this bird," writes Mr. Jerdon, "on the Coonoor Ghaut, in high forest jungle. It was alone, flying from branch to branch, and had been feeding on small insects." The *vibrissæ* in this species are less lengthened and thicker than in the others.

[†] Previously employed in other classes.—G. R. Gray.

nerally similar to that of *O. Galbula*, but the shade of colour darker, especially on the head; beneath throughout yellowish white to the lower tail-coverts which are bright yellow, and lineated with black from the breast; greater wing-coverts conspicuously margined externally with ferruginous, and tertiaries edged with the same towards their tips; primaries slightly edged with whitish; and all the tail-feathers, save the middle pair or uropygials, largely tipped on their inner web with bright yellow, contrasting with deep black: bill pale, and feet greenish lead-colour.*

Anthus Malayensis, Eyton, *P. Z. S.* 1839, 104. This species, which we also possess from Tenasserim, is, I have little doubt, that insufficiently described by the author cited, who should at least have given the length of the wings to help in identifying a member of this difficult genus. It is, he remarks, the *A. pratensis* of Raffles, being nearly allied [in plumage,] to *A. trivialis*, but differing in its larger size. It is also common about Calcutta, and occurs in Southern India upon the Neilghierries, where alone it has fallen under the observation of Mr. Jerdon.

**Coturnix Phillipensis*, Brisson; *Tetrao Chinensis* and *Manillensis*, Gmelin; *C. excalfaloria*, Temminck: male and female.

Ortygis atrogularis.

**Crex fasciatus; Rallus fasciatus*, Raffles, *Lin. Trans.* XIII, pt. II. 328. Nearly allied, it would seem, to *R. fuscus*, Lin. Length eight inches, of wing four and a half to five inches, and tail an inch and a half; bill to forehead seven-eighths of an inch, and tarse an inch and five-eighths; middle toe and claw an inch and seven-eighths. Upper-parts deep rufous-brown, the head, neck, and breast, bright dark ferruginous, paler on the throat; belly, flanks, and under tail-coverts broadly banded white and black, the latter broader in old birds, the former in younger specimens; wings dusky-black banded with white or fulvous-white. "Bill bluish-black, feet red, irides red." (Raffles.) Younger specimens, or perhaps females, have the colours less intense. The immature plumage has no rufous on the head, neck and breast, which are dull grey-brown, and the bars on the under-parts are much less defined; throat whitish.

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* I have obtained the true *O. Galbula* in this neighbourhood, and the other Indian and Malayan species known to me are as follow:—

O. aureus, Gmelin; to which Mr. Jerdon refers the *O. Galbula* of Sykes's catalogue (*P. Z. S.* 1832, p. 87), and also *O. kundoo*, Sykes, as the young bird. It closely resembles *O. Galbula*, but has shorter wings, and the black facial streak passes beyond the eye: from the nearly allied African *O. auratus* it differs in the greatly diminished quantity of yellow upon its wings. Though very common in peninsular India, I have not yet met with it in this neighbourhood.

O. Chinensis, Gmelin; *O. hippocrepis*, Wagler; *O. acrorhynchus*, Vigors, *P. Z. S.* 1831, p. 97; *O. Maderaspatanus*, Franklin, *P. Z. S.* 1831, 118, apud Jerdon, as (doubtfully) the young. BLACK-NAPED ORIOLE. Not common in India, but much more frequent in the countries to the eastward.

C. Hodsonii (Hodgsonii?), apud Swainson, v. *O. melanocephalus* of India, as distinct from that of Africa styled *Capensis* by Swainson, who has described a second black-headed African species as *O. brachyrhynchus*, while a fourth presenting the same character inhabits the Malay countries, and the *O. Traillii* constitutes a fifth. Very common in Bengal, and hardly less so, it would appear, throughout India from the Himalaya southward; extends eastward to China, but is not included in Dr. Horsfield's catalogue of Javanese birds, whereas *O. Chinensis* is there enumerated. *O. McCoshii*, Tickell, *J. A. S.* II, 577, is the once-moulted male.

O. leucogaster, Reinwardt; *O. xanthonotus*, Horsfield, *Lin. Trans.* XIII, pt. I, p. 152, and figured and further described in the 'Zoological Researches in Java.' Malay countries generally.

O. Traillii, Hodgson; *Pastor Traillii*, Vigors and Gould; *Psarophilus Traillii*, Jardine and Selby. Himalaya, and likewise Ava. In all seven oriental species, of which the two peculiar (so far as I am aware) to the Malay countries, — viz. *O. leucogaster* and *O. castanopterus*, — are remarkable for their small size.

In the suite of the foregoing Malayan species, I now proceed to describe a magnificent *Podargus*, which appears to be the *Bombycistoma Fullertonii* of Capt. Hay *(J. A. S. X, 573)*, though not minutely agreeing in all respects with the description furnished by that gentleman. It is the species mentioned in one of my reports, *ante*, p. 106, and there is reason to suspect that the specimen was obtained in the Malay peninsula.

Podargus Fullertonii (?). Length about sixteen inches, of wing ten inches and a quarter, and tail eight inches, its two outermost feathers successively much shorter; bill to gape two inches and a half, and the same broad at base, its vertical height at base about five-eighths of an inch; tarse seven-eighths of an inch. Colour different shades of fine rich rufous-brown, with a banded whitish half-collar at the nape, and very remarkable elongated white spatulate tips to the wing-coverts, laterally margined with black, each being prolonged beyond the dark portion of the feather, and curling upward so as to rise from the even surface of the wing, with the fine dark ferruginous-brown of which they contrast strongly: quills and tail less deep ferruginous-brown, banded with a still paler tint, which is slightly bordered with blackish; scapularies and tertiaries having each a terminal black spot; interscapularies dark, and but indistinctly mottled: crown brown, with little or no rufous tinge, and a subterminal irregular whitish streak, bordered with black, to each plume: feathers of the nuchal collar lengthened and fulvous-brown, rayed with dusky-black, and having a subterminal broad fulvous-white transverse band, which is also edged with black both above and below: under-parts comparatively dull ferruginous brown, with small whitish spots on the breast, and faint mottling; the belly paler; and lower tail-coverts whitish banded with light brown; ear-coverts rufous-tinged, and a pale streak over the eye becoming more conspicuous beyond it. Bill and feet brown, the former whitish towards the gape.

Capt. Hay's second species is probably the *Podargus stellatus*, Gould, *P. Z. S.* 1837, p. 43, being received from Malacca, whereas Mr. Gould's specimen was obtained from Java. His third species appears to be an *Eurylaimus* with which I am unacquainted.

The *Podargus Javanicus*, Horsfield, already noticed by Mr. Eyton as inhabiting the Malay Peninsula, likewise occurs, as I have been informed by Mr. Jerdon, in Southern India, that gentleman having received "a very accurate description" of the species, drawn up from a specimen killed in Coorg. It is rather an unexpected addition to the Ornithology of India.

The more interesting species which I have lately procured in this neighbourhood are as follow:—

Cuculus micropterus.

C. niger, Latham, v. *C. Bengalensis niger*, Brisson; of which the middle-aged female is *C. tenuirostris* of Hardwicke and Gray, and the adult male is the doubtfully cited *C. flavus* of Mr. Jerdon's list: a mature male.

Cypselus affinis, Gray: very abundant at all seasons. *C. palmarum* is less so, and no other species are met with in this vicinity. Of Swallows *(Hirundo)*, I have never yet seen a single individual in Bengal, but the Society possesses an example of *H. rustica*, which was shot at no great distance from Calcutta.

Mirafra Assamica: nestling plumage, which helps to affine this genus to the Larks.

**Dicæum erythronotum*: male and female.

Tephrodornis superciliosus, Swainson, v. *Lanius Keroula*, Hardwicke and Gray. The female of this bird appears to present an extraordinary difference from the male. I brought down two at a shot, from a small party on the higher branches of a tall tree, where they were making much the same kind of noise as a family of young Shrikes. One was a young male, retaining most of its nestling feathers, which on the head and body resembled the corresponding garb of *Muscicapa grisola*, while the wing-coverts, tertiaries, and tail, were those of *Lanius*; and this specimen, like the adult male, has the two outermost tail-feathers almost wholly white; the other bird was an adult female, with no white whatever on the tail, which is besides shorter and less rounded; and the superciliary streak and dark colour of the ear-coverts are also wanting: in other respects the two resemble; but the diversity in the tail is so remarkable, that I imagine few would incline to regard them as specifically the same.*

Columba Javanica: interesting as proving the existence of this beautiful species in the neighbourhood, where indeed (in the Botanic Garden,) it is not uncommon.

Numenius arquata.

Tringa subarquata: fine summer plumage.

**Gallinula lugubris*; Horsfield, *Lin. Trans.* XIII, pt. I, p. 195: male.

**Rallus rufescens*, Jerdon, *Madr. Jl.* No. XXIX, 205: female.

A considerable number of skins have likewise been set up.

I am, Sir,

Your's obediently,

EDWARD BLYTH.

Appendix to Report, No. I. —— The Asiatic Drongos (*Edolius*, Cuv.). Upon a former occasion (*ante*, p. 169 *et seq.*), I was partially successful in my endeavour to elucidate the various Oriental species of this group, which I am now enabled to monograph, I think, satisfactorily: and to aid the student in determining the various species with which I am acquainted, I annex a plate with figures of the beak of each of them, and proceed to offer a conspectus of the series with their synonymes.

Subgenus *Criniger*, Tickell, 1833; *Cometes* (olim *Chibia*), Hodgson, 1837.

1. *Edolius Crishna* (Latham), Gould; —— *splendens*, Tickell; —— *casia*, Hodgson: ante, p. 171. Figs. 1 and 2.

Subgenus *Edolius*, (Cuvier), Nobis; *Cometes* (in part), Hodgson.

2. *E. grandis*, Gould; —— *malabaricus*, Shaw and Stephens; —— *malabaroides*, Hodgson: *ante*, p. 170. Figs. 5 and 6.

3. *E. retifer*, Temminck; —— *platurus*, Vieillot; —— *malabaricus* Gould; —— *cristatellus*, Nobis; —— *grandis*, apud Horsfield†: ante, p. 170. Fig. 7.

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* I have since shot a female of this species not differing from the male, which leads me to conclude that the female above noticed is distinct.

† Identified as such by Dr. McClelland's drawing of the specimen; and accordingly Dr. Horsfield's remark is explained, that the Assamese specimens of supposed *grandis* "agree with the specific character and description given by Mr. Gould in all points excepting the size, being about one third smaller." The present is also Mr. Jerdon's species.

4. *E. Rangoonensis*, Gould;—probably the *Malabar Shrike* or *Drongo* of Buffon and Sonnerat:* *ante*, p. 172. Figs. 8 and 9.

N. B.—— Either the first or second of these three species (probably the first of them) is the *Cuculus Paradiseus*, Lin., the *Coucou vert huppé de Siam* of Brisson; or *Coucou à longs brins* of Buffon, as founded on a drawing by a M. Poivre, who had figured the feet to be zygodactyle: the same artist had in like manner misrepresented the *Pica (Cyanocorax) erythrorhynchos*, which accordingly has been described as the *Coucou bleu de la Chine, en langue Chinoise, San-hia*, of Brisson and Buffon, and the *Cuculus Sinensis*, Linnæus. This species was observed in Chusan by Dr. Cantor.

Subgenus *Melisseus (olim Bhringa)*, Hodgson.

5. *E. remifer*, Temminck; —— *tectirostris*, Hodgson; —— *Rangoonensis (?)*, apud Horsfield: *ante*, p. 169. Figs. 3 and 4.

Subgenus *Prepopterus (olim Chaptia)*, Hodgson.

6. *E. æneus*, Vieillot; —— *muscipetoides*, Hodgson. Figs. 20 and 21. *Butchanga* of the Bengalees.

Subgenus *Dicrurus* (Vieillot), G. R. Gray, olim *Buchanga*, Hodgson.

7. *E. viridescens (?)*, Gould: ante, p. 173. Figs. 10 and 11.

8. *E. balicassius* (Linnæus);—*affinis*, Nobis (*ante*);—Javanese *forficatus (?)*, Horsfield: *ante*, p. 174. Figs. 12 and 13. A fine adult, recently obtained from Singapore, has the wing five inches and three-quarters long, middle tail-feathers four inches and three-eighths, and the outermost above seven-eighths of an inch additional; the tip of the latter curling nearly as much as in *E. Fingah*, from which species this differs in its shorter and much less deeply forked tail, and in the superior size and much greater vertical height of the bill, the upper ridge of which is also considerably more angulated.† In both the abdominal feathers of the once moulted birds are tipped with greyish-white, which totally disappears in the plumage of full maturity. I doubt whether that now under consideration occurs in India, but it seems to be the common species of the Malay countries generally, including the Phillipine Islands (from whence it was originally described by Brisson and Buffon), and it is said to extend even to Australia (apud Vigors, *Lin. Trans.* XV, 211).

9. *E. Fingah*, Shaw (the young),—*Indicus*, Stephens (the adult);—*albirictus*, Hodgson;—*balicassius*, Nobis (*ante*), as also of Jerdon and other writers on the Ornithology of peninsular India. Figs. 14 and 15. Shaw appears to have had no further authority for this species than Edwards's figure of the "Fork-tailed Indian Butcher-bird," which he erroneously refers to *Lanius cærulescens* of Linnæus; and holding this opinion, he had no right to clog our systems with a superfluous name: quoting, too, the Linnæan definition of *cærulescens*, and perhaps following Edwards's description, or, it may be, describing from that author's plate, it would seem that the most has been made of the whitish tips to the abdominal feathers of the young of our present species, thus bearing out the mal-identification with *cærulescens*.

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* "Il manque de huppe."—Buffon.

† This bird is the *Corvus balicassius* of Linnæus, and in truth its beak partakes much of the corvine form, so that the species might be styled with propriety the *Crow-billed Drongo*, as the next might be equally well named the *Shrike-billed Drongo.*

His statements, however, that "this species is described and figured by Edwards, from a specimen brought from Bengal, where it is known by the name of ***Fingah***," and that "it is said to be a great persecutor of the Crows, which it attacks and obliges to quit its haunts," leave no doubt in my mind that the present is the species intended, inasmuch as though others of this genus likewise drive away the Crows, still this is the common ***Fingah*** of the Bengalees, familiarly known to every body, and its beating off the Crows and even Kites is here a scene of daily observation. A seemingly constant character of this species is a minute white spot at the rictus, which does not occur in any of the other species, and hence the appropriate name of ***albirictus*** bestowed by Mr. Hodgson.

10. *E. macrocercus*, Vieillot;—*annectans*, Hodgson, — ***Muscicapa biloba***, Lichtenstein, apud Griffith's work;—*Neel Fingah* of the Bengalees: *ante*, p. 173. Figs. 16 and 17.

11. *E. cœrulescens* (Linnæus). Figs. 18 and 19.

12. *E. cineraceus*, Horsfield, *Lin. Trans.* XIII, pt. 1, p. 145;—probably also *D. leucophæus*, Vieillot, *Dict. Class d'Hist. Nat.* V, 621, which, with *D. Ceylonensis*, Stephens, are referred to (and the latter founded on) the [1]*Drongri* of Levaillant. "*E. cineraceus saturatus concolor, remigibus supra ad apicem rectricibusque lateralibus margine exteriore, nigris. Longitudo* 11 *poll*" Horsfield: who adds that—"Although very similar to *forficatus* [which I suspect to be *balicassius verus*], it must be considered a distinct species; the bill is more robust, and the exterior tail-feathers form a greater curve; it is much less common, and the natives of Java distinguish it by a peculiar name." *Dicrurus leucophæus*, Vieillot, is briefly described as having "*tout le plumage d'un gris plombé avec l'extremité des remiges d'un brun noirâtre; barbes exterieures des rectrices noires; queue longue et fourchue; bec et pieds plombés. Taille, neuf pouces. De Ceylon et de Java.*"

13. *E. leucogaster* (Vieillot), *Dict. Class. d'Hist. Nat.* V, 622 (1824); *D. albiventris*, Stephens, (1825): founded on Levaillant's *Drongo gris à ventre blanc*, and suspected by both Vieillot and Stephens to be merely a variety of the last, or *leucophæus*, Vieillot. "It chiefly differs in having all the under-parts, *from chin to vent*, white," and therefore cannot be identified with *cœrulescens*, to which Mr. Jerdon has assigned *leucogaster* as a synonym.

14. The only remaining species which I can find ascribed to this part of the world is *D. æratus*, Stephens. "Inhabits Bengal. Beak and legs black: general colour of the plumage above black, with a brilliant changeable blue gloss, like bronze, in some lights appearing green: belly, sides, and under tail-coverts, dull black-grey; underparts of the wings and tail black; the last forked: the hairs about the nostrils point forward [as a matter of course], and there is a large oval patch of black beneath the eye." Is much in need of verification.

Explanation of Plate.

Figs.	1 and 2	*Edolius*	*krishna.*
,,	3 and 4	,,	*remifer.*
,,	5 and 6	,,	*grandis.*
,,	7	,,	*retifer.*
,,	8 and 9	,,	*Rangoonensis*
,,	10 and 11	..	*viridescens* ?

Figs. 12 and 13 ***Edolius balicassius.***
,, 14 and 15 ,, ***Fingah.***
,, 16 and 17 ,, *macrocercus.*
,, 18 and 19 ,, *cœrulescens.*
,, 20 and 21 ,, *æneus.*

Appendix, No. 2.—Genus *Turnix,* Bonn. (1790); *Tridactylus,* Lacepede; *Ortygis,* Illiger; *Hemipodius,* Temminck: the *Three-toed Quails* of sportsmen. On a former occasion (Vol. XI, p. 586), I referred a pair of specimens, male and female, of this genus, to the Malayan *T. atrogularis,* Eyton, *P. Z. S.* 1839, p. 107; to which also I now find that I should have assigned the Malayan female noticed at p. 204, and there wrongly identified with *T. taigoor* of Sykes, which latter is, however, included by Mr. Eyton in his list of a collection of Malayan birds, wherein he has characterized the *T. atrogularis:* but the similitude of some females of these species is so extremely close, that it is almost (if not quite) impossible to discriminate them, even though ordinarily they are distinguishable at a glance; and now that the Singapore collection noticed in the foregoing report has yielded undoubted examples of both sexes of *T. atrogularis,* it appears to me that of the pair first mentioned, the male pertains decidedly to that species, while the female sent with it should perhaps be referred to *T. taigoor.* I have now four continental eastern species before me, of which the males of three would appear to be normally distinguished from the other sex by having the throat and middle of the fore-neck and breast jetty-black; but in *T. atrogularis* this black is very much broader than in *T. pugnax* and *T. taigoor.* Col. Sykes states, indeed, that the last mentioned species is devoid of this colour, which is the case with one specimen marked male in the Society's Museum, but another example before me has fully as much of it as *T. pugnax:* again, of the latter species, remarks Mr. Jerdon, "Col. Sykes and M. Temminck assert the identity of the plumage of both sexes [each having the mark], and though I did not examine them when I shot several in company, they were always clothed alike"; on the other hand, M. Drapiez states *(Dict. Class. d'Hist. Nat.,* Art. *Turnix),*—"La femelle [of *T. Pugnax*] a généralement les couleurs du plumage beaucoup moins vives; la bande longitudinale de la gorge au lieu d'être noire est blanche avec un simple trait noir qui l'encadre; le milieu du ventre est d'un blanc roussatre." Of the *T. Luzoniensis,* v. *H. thoracicus,* Tem., of the Malayan Archipelago, Sir Stamford Raffles observes, that "the throat is black in the males, generally whitish in the females"; and I imagine that the fully adult males of all these exhibit the black mark, while (in various degrees, according to the species,) the young males, and a greater or less number of old in addition to the young females, are devoid of it, some also presenting a mere trace of this marking, as stated by M. Drapiez of the female of his *pugnax:* and it should be borne in mind that this is a genus of which several species are so closely allied together, and withal so numerous in species, that in cases of conflicting testimony there is generally much room for doubt whether precisely the same species be intended by different writers.

I proceed to offer descriptions of all the oriental species which I know of.

1. *T. pugnax,* apud Sykes and Jerdon; perhaps *Tetrao nigricollis* and *Madagascariensis* of the older authors, though it is unlikely that the very same species inhabits Madagascar. Length six inches and a half; of wing three inches and a half; bill to forehead (through the feathers) nearly five-eighths of an inch, and fully a quarter of

an inch in vertical depth; tarse an inch, and middle toe and claw seven-eighths of an inch. Upper-parts rufous, with transverse black lines on each feather of the back, scapularies, and rump, these having also yellowish-white lateral margins, internally edged with black; sides of the lower part of the neck and breast, together with the more conspicuous feathers of the wings, fulvous-white, with tolerably broad black cross-bars; below the breast light and bright ferruginous; throat and middle of the fore-neck, to the commencement of the breast, deep black; and crown rufous, with a series of black and white feathers, appearing as white spots set off with black, along the mesial line, another and broader series over each eye, a third bordering the black throat, and the sides of the upper-part of the neck covered with the same, appearing as whitish with black edgings to the feathers; quills brownish-dusky, with pale edges. The description of the female by M. Drapiez has already been cited, whilst M. Temminck and Col. Sykes assert that it does not differ from the male. The example here described is from Madras, and the species is understood to inhabit the Indian peninsula where it is tolerably common, Java, and (very doubtfully) Madagascar.

2. *T. taigoor,* Sykes: 'Bengal Sporting Magazine,' Oct. 1836, pl. I, fig. 6; *H. plumbipes,* Hodgson, Ibid. May, 1837, p. 346; 'Bombay Literary Transactions,' II, 271. The species which I conclude to be this, presents scarcely any difference in plumage from the preceding: the upper-parts are merely browner and less rufous, especially the head and nape, and the black cross-bars of the dorsal feathers are commonly broader and incline to be confluent, the markings generally being somewhat less clearly defined; but the size is inferior, and the beak proportionally more slender. Length five inches and three-quarters; of wing three inches and one-eighth, or less; bill to forehead (through the feathers) nine-sixteenths of an inch, and under three-sixteenths in vertical depth; tarse not seven-eighths of an inch, and middle toe and claw three-quarters of an inch. The male specimen before noticed as wanting the black gular streak has also the light ferruginous colour below the throat paler and less developed, the throat being spotless whitish, flanked with dusky specks. This appears to be the species figured in the 'Bombay Literary Transactions,' as above cited, which is stated to be common in Guzerat and in Malwa. "Extent of wings nine inches and a half." In the peninsula, Mr. Jerdon has "only procured it solitary, in long grass in the more open spaces of the Western coast." It is not uncommon in the vicinity of Calcutta, where I have found it breeding, in the Botanic Garden. As occasional females of this and of the next so much resemble, and Mr. Eyton, while enumerating *T. taigoor* in his list of species from the Malay peninsula, describes only the male of his *T. atrogularis,* it is certainly not improbable that he mistook the female of that bird for the present species.

3. *T. atrogularis; H. atrogularis,* Eyton, *P. Z. S.* 1839, p. 107. Intermediate in size to the two preceding species, with as stout a bill as the first (in old males), and seldom much trace of rufous on the upper-parts, the predominant hue of which is a sort of dusky-chocolate, having much black intermixed, the transverse lines mostly confluent and suffusing a considerable portion of the feather; the black bars on the sides of the breast and wings, also, are broad, so as to assume an oval or even round form, and the fulvescent tinge on the belly is not very deep, and mostly extends up the breast; the black of the breast and fore-neck of the male is, as

already noticed, very much broader than in the others, whence this sex may always be readily distinguished, which is not the case with the females in every instance, even by referring to the thickness of the bill, which presents a much less marked distinctive character than in the male. Length about six inches, of wing three inches and three-eighths, or generally under three inches and a quarter in the female; bill to forehead (through the feathers) five-eighths; and tarse an inch, middle toe and claw seven-eighths of an inch. It is evidently very common in the neighbourhood of Singapore, and occurs in the Tenasserim provinces.

4. *T. Dussumieri*, 'Bengal Sporting Magazine,' October, 1836, pl. I, fig. 5; *Hemipodius variabilis*, Hodgson, Ibid. May 1837, p. 345; *Button Quail* of sportsmen. This is the most abundant species of India generally, including Bengal, and it extends northward into Nepâl, where it is also numerous; but I have not yet seen it from the eastern side of the Bay. Its length is five inches and a half, with wing two inches and three-quarters; bill slender, and half an inch to forehead through the feathers; tarse three-quarters of an inch, and middle toe and claw five-eighths of an inch. Throat whitish in both sexes, flanked with a few transverse dusky specks; and middle of the breast of the same fulvescent hue as the belly of the others, more or less deep: the colour of the upper-parts most nearly resembles that of *T. pugnax*, but the black is rather more predominant, especially on the rump which is chiefly of this hue; the belly is whitish; and the wings marked differently from those of the three preceding species, having a whitish ground-tint, upon which each feather shews a large rufous spot, containing a smaller black one externally; and these spots being longitudinal instead of transverse.

The following oriental species have also been described, and it will aid the student to give detailed notices of them.

5. *T. nigrifrons; H. nigrifrons*, Tem. "Six inches in length, having the forehead ornamented with three broad bands; the first of which is formed of small white feathers, arising from the base of the beak to the nostrils; the second, which is twice as broad as the first, is deep black; and the third, which extends beyond the eyes, pure white: the top of the head is of a fine red, with delicate black stripes in the middle of the feathers; the nape is slightly tinged with bright olive; the back, rump, and upper tail-coverts are of a reddish-yellow, tinged with black and fawn-colour; the lesser and middle wing-coverts are yellowish, each feather having a small black spot towards its tip; the secondaries and greater quills are grey; the throat bright reddish-yellow; neck and breast the same, having all the feathers sprinkled with semicircular black spots; belly and thighs pure white: bill red; and feet reddish, the claws black. Said to be a native of India, and described by Temminck from a single specimen in the Paris Museum." Stephens, in Shaw's Zoology.

6. *T. maculosus; H. maculosus*, Tem. This is an Australian species, but is stated in Griffith's work also to inhabit India, upon the authority of Gen. Hardwicke; and I make no doubt that the Indian bird here referred to is the same as that figured, together with another little known species, as two different *Bustard Quails* of sportsmen (both of them differing also from the preceding species of this genus), in the 'Bengal Sporting Magazine' for March, 1838, the present being represented as fig. 2 of the plate. The following is Stephens's description of the *O. maculosus* of Australia, in the Appendix to Shaw's 'Zoology.' "Distinguished by its very short

tail, which scarcely exceeds the tips of the wings when closed; its length is five inches: the top of the head is varied with black spots, and the whole of the feathers are tipped with greyish-red; a white band extends over the crown; the eyebrows, sides of the neck, and nape, are bright red; the throat and cheeks reddish-white; the fore-part of the neck, breast, belly, sides, and thighs, are red, and (with the exception of the feathers of the sides and those of the edge of the breast, which are varied with stripes of black and reddish-white,) they are spotless; the feathers of the top of the back and the scapularies are black in the centre, bordered with white, and tipped with red; those of the middle of the back and the long ones which hide the tail, are deep black, varied with rufous undulations, and slightly edged with yellowish; the scapularies are a little spotted with grey-blue; the wing-coverts are reddish-yellow; the whole of the feathers with a black spot near the tip, and the longer ones with the inner webs red, spotted with black; primaries and secondaries bright grey, edged with reddish-white; the bill and feet fine yellow." Capt. Brown's figure of the Indian bird before referred to accords tolerably well, upon the whole, with this description, differing chiefly a little about the head.

7. The other *Bustard Quail* is identified by that gentleman with the *Dubkee Quail* of Latham, *Gen. Hist.* VIII, 340, and which is thus described by that author. "Length under five inches. Bill pale. Head mottled whitish and ash-colour; all round the neck and sides ferruginous; down the middle from the chin, paler ferruginous; the rest of the upper-parts fine pale ash-colour, varied with paler spots, inclining to rufous; under-parts cinereous clay-colour, marked on the sides of the breast with round black spots of several sizes; greater wing-coverts and second quills pale clay-colour, spotted with black, some of the spots kidney-shaped; greater quills and tail plain dusky; legs yellow, and three toes only. Inhabits India, where it is called *Dubkee.*" Sir J. Anstruther.

"*A.* Bill and legs yellow: plumage in general pale grey, crossed with fine black lines; lower part of the neck behind, inclining to rufous; breast the same; outer part of the wing and breast marked with small, distinct spots of black. Inhabits India and China, called *Looah,*" — a name commonly bestowed on the tiny Bush Partridge, classed as *Coturnix Argoondah* by Col. Sykes.

Capt. Brown's figure of this species represents the back as handsomely ornamented with round white spots, margined with black.

8. Dr. Latham also describes a *Balen Quail,* which is very probably the *taigoor,* notwithstanding certain discrepancies. "Size uncertain. Bill black. Top of the head, even with the eyes, marked brown; down the middle of the crown a pale clay-coloured streak, and another over each eye, almost to the back; the chin, sides under the eyes, and throat, white; sides of the neck and breast clay-colour; down the middle, from the throat to the breast, a broad black streak; the rest of the under-parts pale clay-colour, each feather marked down the middle with a long black streak, rounded at the bottom; back and wings pale mottled brown, as the head, marked with a series of pale yellow streaks down the middle and two others of the same on each side, besides some fine similar lines from the shaft of each feather; legs pale red, three toes only.

"Inhabits India, called *Balen.* Sir J. Anstruther."

"One supposed to be a female, is marked much the same about the head, but without the black down the breast, or the transverse curved marks on the throat: sides of the body dirty-white, with fewer black spots."

"With the above, another of the first. The plumage much the same, but darker in colour, and the under parts flesh-colour instead of pale rufous, or clay-colour. This is called *Gassur*, and is probably a young bird; the specimen differs however, in having on one leg a rudiment of a hind-claw."

"*A*. Length five inches. Bill pale blue; above, the body is pale mottled ash-colour, with a series of yellowish streaks; also some large spots of blackish before, and marbled behind; the wings pale brownish rose-colour, chequered with white, and in the interstices a spot of black; greater quills dusky; along the middle of the crown a slender yellow streak; the rest of the crown marbled; sides of the head paler; round the eye nearly white; beneath the bird is wholly buff-colour; sides of the breast spotted with black; tail blotched with brown; legs flesh-colour, no hind-toe."

"Inhabits India. Gen. Hardwicke. Taken in Cawnpore in May."

9. *T. Luzoniensis; Tetrao Luzs.* Gmelin: *H. thoracicus,* Tem.; *Turnix maculatus,* Vieillot. Common in the Eastern Archipelago. "About seven inches in length: the top of the head, cheeks, and nape, covered with black and white spots, more numerous on the former; the feathers of the throat are white, tipped with black; the under-part of the neck and breast are fine bright red; the belly, sides, and thighs, bright yellowish; back, rump, and feathers covering the tail, grey-brown, marked with delicate zig-zag black lines; the greater and lesser wing-coverts whitish-yellow, varied with black spots, having a bright red transverse line above each of the latter; the greater feathers of the wing are grey-brown, and spotless." Stephens.

Sir Stamford Raffles remarks, that "The colours vary much in different specimens. The head, back, and wings are varied with black, brown, and fawn-colour, of which sometimes the one, sometimes the other, predominates. In full-grown birds the head is generally black, spotted with white, particularly at the sides, while the back is more of a red-brown, and the wings are black, banded with white. The breast also varies, being sometimes ferruginous, but at a later period becoming marked with transverse bars of black and white. The abdomen is always of a ferruginous colour. The throat is black in the males, generally whitish in the females. Bill rather long, yellowish, which is also the colour of the legs. Irides white.

"These Quails are frequently kept tame, and the females are trained to fight with each other by the natives. The superior courage of the females has given rise to a common Malay proverb, in which a hen-pecked husband is compared to a *Puyu.* This species is always seen in pairs, never in flocks like the *Pikau (Coturnix Phillipensis).*

"I am at loss to discover," continues Sir Stamford Raffles, "what species of Quail is intended by the *Tetrao suscitator*, or Indian Quail of Bontius. The *Pikau* and *Puyu* are the two generally known throughout the Eastern Islands. The latter is the most frequently domesticated, and becomes as tame as the common fowl. It is the only one trained for fighting, and they will often combat with such fury as to kill each other. It is not however noisy, and in the wild state is only seen in pairs. The *Pikau,* on the contrary, has a loud clear note, is seen in flocks, will not become so tame as the other, and is not valued for fighting. It would seem as if the manners of both were confounded in the account given of *T. suscitator. Lin. Trans.* XIII. pt. II, p. 324.

T. Luzoniensis is also the only species included in Dr. Horsfield's Catalogue of the Birds of Java; but it may be that the *H. pugnax* of Temminck is regarded by Sir Stamford Raffles merely as a particular state of plumage of his *Luzoniensis*, for M. Temminck informs us that *H. pugnax* inhabits Java, where it is greatly prized on account of its pugnacious disposition, the inhabitants amusing themselves by setting the males (?) to fight in the manner of game-cocks. [Col. Sykes, it may here be mentioned, takes upon himself to assert of his *H. pugnax* that "its pugnacious qualities are quite unknown in Dukhun, and even in Java."] I should not be surprised if *T. atrogularis* should prove to be identical with the Javanese *pugnax*, while it is quite distinct from a Madras specimen of Col. Sykes's Indian *pugnax*, this being the only one I have to compare with several specimens of Mr. Eyton's *atrogularis* received chiefly from Singapore. Of *T. Luzoniensis*, I have no specimen to refer to, but there is a rude figure of this bird in Sonnerat's *Voyage à la Nouvelle Guinée*, upon which its specific name was founded. *La petite Caille de l'Isle de Luzon* of this author, represents the female of *Coturnix Phillipensis.*

10. *T. fasciatus; H. fasciatus*, Tem. Inhabits the Phillipines. "Rather above five inches in length. The whole of the fore-part of the neck, the sides of the head and of the breast, transversely striped with black and white; belly spotless red; top of the head black; the region of the eyes striped alternately with white and black; nape bright red; back and rump brown, varied with black and red; wing-coverts transversely striped with black and white; the feathers nearest the body having their outer webs black, tipped with grey: the feet and beak are yellowish." Stephens.

11. *T. rufus*, Vieillot. "*O. corpore suprà cinereo, punctis nigris; jugulo nigro alboque vario; corpore subtùs, remigibus primariis, rectricibusque lateralibus fusco-rufis; rostro corneo, basi nigricante, pedibus rubescentibus.*" Inhabits China.

Various other species of this genus occur in Australia, the whole of Africa, even Spain, and probably other parts of Southern Europe, and doubtless Western Asia; but there is none in America. The Society's Museum contains two from the Cape colony, of which one appears to be the *Spotted-necked Quail* of Latham, and the other (a pretty, small, red-breasted species,) I cannot find described; but then I have not Dr. A. Smith's 'South African Zoology' to refer to. I have brought together all the notices I could find of eastern species, though I do not expect that so many will eventually be verified as distinct; but the data here collected will be useful in assisting the investigations of such as may now bestow attention on the group, and certainly may be presumed to intimate that the latter is richer in Indian species than has hitherto been currently supposed.

The other small *Gallinaceæ* classed with the preceding as *Quails* by Anglo-Indian sportsmen are as follow,—all having a fourth or hind toe.

True Quails (genus *Coturnix)*, having the first quill longest, the tarsi having no trace of spurs, &c. Habits migratory.

1. *C. dactylisonans:* the Common Quail. An inhabitant of Europe, Asia, and Africa, to the Cape of Good Hope. It is very abundant in the Upper Provinces of India during the cool months, less so in the peninsula, and is the most frequent species of *Coturnix* in the vicinity of Calcutta. Is rarely known to breed in this country.

2. *C. textilis*, Tem.; *Perdix Coromandelica*, Latham: the ***Rain Quail*** of sportsmen. Distinguished from the last by its smaller size, the plainness of its primaries, and especially by the black breast of the male. Is very numerous in the cultivated parts of the Indian peninsula, where many breed; but great numbers arrive in the N. E. provinces of the Bengal Presidency early in the rains, and, after breeding, depart thence (save a few stragglers, which are observed at all seasons,) in September. It is not common about Calcutta; and in Nepâl its migrations resemble those of the common species.

3. *C. flavipes*, Nobis. A remarkably diminutive species, which I understand is not rare in Bengal during the cool season. I procured a fine male alive, which I kept some time, but it unluckily made its escape. Afterwards I obtained a female, in bad condition, both of them having been brought with Larks, &c., by the bazar shikarees, and this, when it died, was ruined as a specimen by the Ants. However, its dimensions were—Length five inches and a half, by nine inches and a half in extent, the wing two inches and seven-eighths, and tarse seven-eighths of an inch. Legs bright yellow. The plumage does not differ much from that of the common Quail, and the sexes are similarly distinguished. This bird has a remarkably soft, piping note.

4. *C. Phillipensis*, Brisson; *Tetrao Chinensis* and *Manillensis*, Gmelin; *Coturnix excalfatoria*, Temminck. "There is an accurate description of this species of Quail," writes Mr. Jerdon, "in Mr. Elliot's notes, taken from a single specimen shot by a gentleman near Belgaum, in the southern Mahratta country." The Society has also received Nepâlese specimens from Mr. Hodgson: and Mr. Frith assures me that he has found it tolerably common in different parts of Bengal, as near Islampore, where he resides. In the Malay countries generally, it appears to be very abundant. Some notice of its habits, as the *Pikau* of Raffles, has been already cited. It is remarkable for the great dissimilarity of the sexes, and the male is perhaps the most beautiful bird of its genus.

The three next are pigmy Partridges, and exhibit every character of the genus *Perdix*, both as to form and habits; insomuch that I cannot recognise the genus *Rubicola*, Hodgson, proposed for them in the 'Bengal Sporting Magazine' for May, 1837. Col. Sykes unaccountably ranges them in *Coturnix*, as if size alone were sufficient to refer them to that group.

5. *Perdix Argoondah: Coturnix Argoondah*, Sykes, *P. Z. S.* 1832, 153; *P. olivacea*, Buchanan Hamilton; *Java Partridge* of Latham: ***Bush Quail*** of sportsmen.* Generally diffused over all India, where there is any low cover.

6. *P. rubiginosa*, Valenciennes; *Coturnix Pentah*, Sykes, Ibid; ***Forest Quail*** of sportsmen. Southern India only.†

7. *P. erythrorhyncha; Coturnix erythrorhyncha*, Sykes: ***Black Quail*** of Neilghierry sportsmen. Elevated districts of Southern India only.

Addendum.—Since the first portion of this report has been made up at the press, the Society has received from Mr. Jerdon, with numerous other specimens, a skin of his *Timalia platyura* (vide p, 796, note to preceding page), and I consider this bird to belong strictly to the Indian form of *Dasyornis* (Jardine and Selby), being the fourth Indian species referrible to it with which I am now acquainted.—E. B.

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* Also termed *Rock Quail* in the peninsula.

† Mr. Frith, however, has since informed me that he is tolerably positive of having once obtained this species in Bengal.

Museum Economic Geology.

Read the following letter from the Deputy Secretary to the Government of India, of 8th June last:—

No. 575.

To H. Torrens, Esq.
Secretary to the Asiatic Society.

General Department.

Sir,—With reference to the Correspondence noted in the margin, I am directed to transmit for the information of the Asiatic Society, the annexed Extract Paragraph 104, from a despatch from the Honourable Court of Directors in the Public Department, No. 6 of 1842, dated 22nd March, and to request that when several specimens of the same Minerals are received in the Museum of the Asiatic Society, duplicates thereof may be forwarded to this Department, properly packed for transmission to the Honourable Court.

From Officiating Secretary Asiatic Society, dated 12th June 1840, with Enclosure. To ditto dated 17th June.

I have the honour to be, Sir,
Your most obedient servant,
H. V. Bayley,
Depy. Secy. to the Govt. of India.

Council Chamber,
The 8th June, 1842.

Extract from a Letter No. 6 *of* 1842, *from the Honourable Court of the Directors in the Public Department, dated the 22nd March.*

104. As several specimens of the same Minerals are likely to be frequently received in the Museum of the Asiatic Society, we should like to be furnished with duplicate specimens of which the locality has been ascertained,

2 & 3. Dr. T. Thomson appointed Curator to the Museum of the Asiatic Society on the allowance authorized by the Court. The acknowledgment of the Society presented to the Court for their liberal patronage.

(True Extract,)
H. V. Bayley,
Depy. Secy. to the Govt. of India.

Read the following Report of the Joint Curator for the month of June last:—

Report of the Curator, Museum Economic Geology, for the month of June.

Museum Economic Geology.—We have been principally employed in this month in searching for, and arranging from the Society's old collections, a suite of Indian Iron Ores; and I have the pleasure of exhibiting a commencement of 69 specimens, comprising 34 species and varieties, some of which are new, as Indian Ores of that metal, as far as I am aware. The crystallised Phosphate of Iron No. 39, from Bundlecund, and the earthy Phosphate No. 66, from Assam, are the most remarkable of these. The series from Bundlecund is valuable as relating to Capt. Franklin's excellent paper and map in the XVIIIth vol. of our Transactions. We have also made some progress in the arrangements of the Indian Copper Ores.

Geological and Mineralogical Museum.—We have to announce here a discovery of the very highest importance to Indian Geology, which is that of Captain Herbert's MSS. Geological Report, and moreover the certainty, from its title page, that it was accompanied by a Geological Map! and six coloured Views. The following letter, addressed by our Secretary to Government, entreating its assistance in the search for this invaluable document, will sufficiently explain its importance, and it is therefore needless to dilate farther upon it here.

To G. A. Bushby, Esq.
Secretary, General Department.

Sir,—The Committee of Papers of the Asiatic Society of Bengal desire me respectfully to state for the information of Government, that after upwards of eighteen months of persevering search, five volumes of Notes and Field Books, relative to Captain Herbert's Geological and Mineralogical Survey of the Himalayas, have been recovered; and to this they have now to add also, the discovery of the Manuscript of his detailed Geological Report.

2. And from the title page to this Manuscript they further learn, that it was accompanied by a Geological Map and six coloured Views, which appear to have been sent in to Government with it.

3. The importance of the recovery of this great mass of Scientific Knowledge, which with the extensive collection in the Society's rooms are the fruit of this costly survey, they will not dilate upon; but they beg earnestly to bring to the notice of Government, the immense value, both scientific and strictly financial, of the Geological Map could it be also recovered; and in confirmation of this opinion they may refer to the vast labour and expense which for the last twenty or thirty years past, has been bestowed, both in Europe and in America, upon Geological Surveys and Maps of various countries: (and especially of England and Scotland,) under the full conviction of the immense political advantages which have been, and are to be eventually derived from them.

4. They trust then, that under these convictions, and with the hope that this really national loss, (for such it would strictly be both to India and to England,) may be yet averted by the recovery of this valuable document from amongst the archives of Government, they therefore respectfully request, that strict search may be ordered in the records of the General and Political Secretariats, the Surveyor General's Office and any others, for any kind of Geological Maps, Sketches or Survey by the late Captain Herbert or other persons. The date of his Manuscript Report is 1826.

Museum, (Signed) H. Torrens,
1st *July*, 1842. *Secretary, Asiatic Society.*

I may however be permitted to add that, from the great talent, untiring industry, clear and patient detail of facts, and absence of all leaning to hypothesis which distinguished so greatly our lamented associate, Captain Herbert, we may fairly hope, that if the Map is recovered, the Society at no distant day may have the satisfaction of doing full credit to the liberality of Government in the outlay for this costly Survey, and ample justice to his memory.

Amongst the old papers of the Physical Committee, we have also discovered a valuable one by Dr. John Adam on the Geology of Bundlecund, and this has enabled me to recognise Catalogue No. V. of our Geological collections, as being the series pertaining to this very paper, which is now in the press for the Journal. When I state that it extends from Mirzapoor to Jubbulpoor, giving thus an excellent Geological outline for that distance, its value will be easily understood.

I have again renewed every search for the Catalogue relative to Captain Pemberton's Geological Series from his Bootan Mission, to which we have no clue, but a very complete set of numbers on the specimens. Some hints from his Assistant, Captain Blake, lead me to hope, that the references, as in the case of Captain Herbert's collection, may be dispersed throughout his Note and Field Books, and I have written to Major General Macleod on the subject. We have no contributions to announce for this month.

H. Piddington,
Cur. Mus. Econ. Geol.

Museum, 30*th June*, 1842.

ADVERTISEMENT.

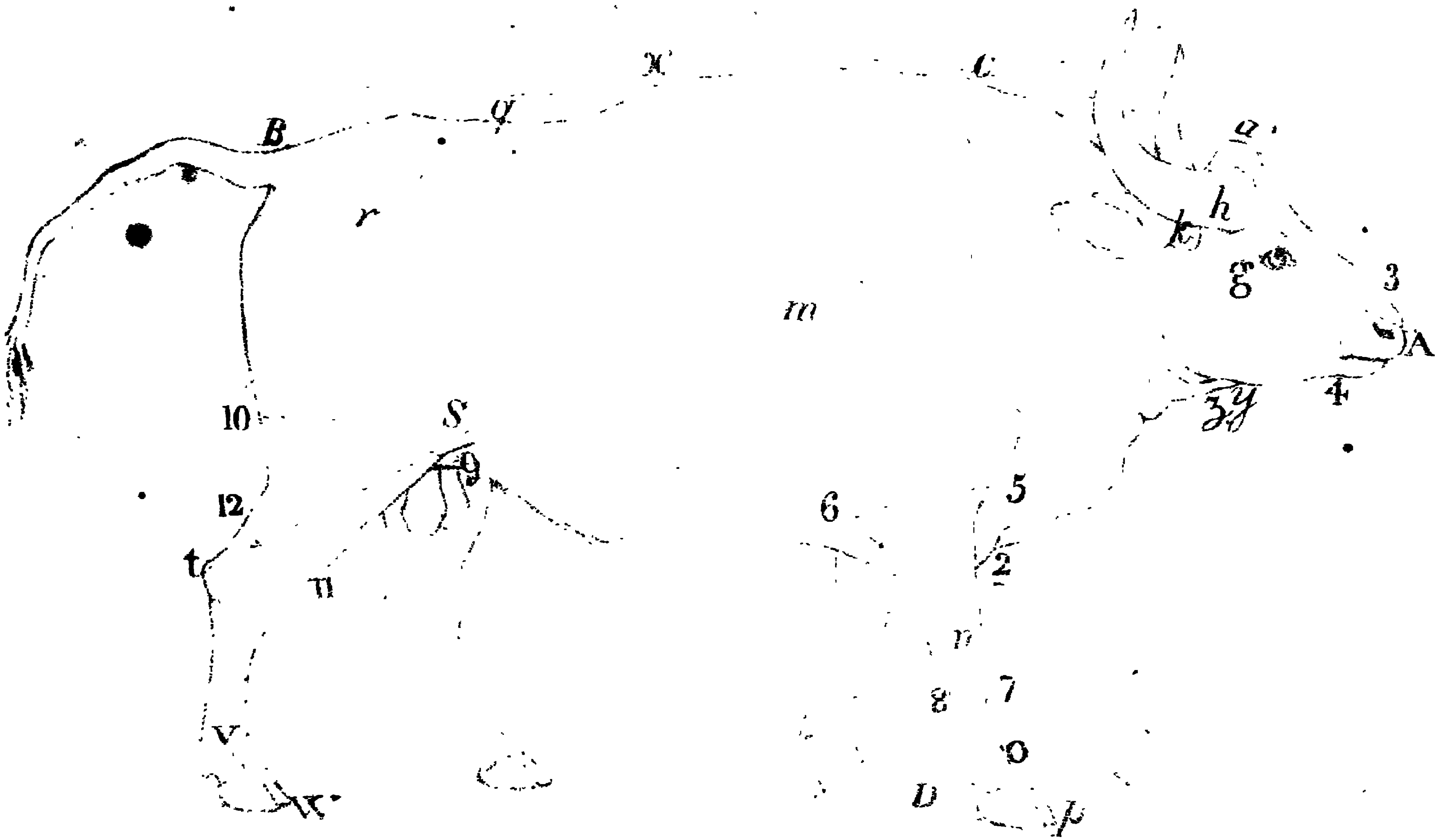
The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the

Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the remarkable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to number at present only, we are able to estimate the riches of the whole creation, and to explain the alterations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after, the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°, with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

Herman von Meyer.



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JOURNAL

OF THE

ASIATIC SOCIETY.

Contributions towards a History of the development of the Mineral Resources of India. By S. G. Tollemache Heatly, *Esq.*

It is often imagined that whatever of scientific or commercial enterprize has been exhibited in India, bears a very modern date under the British rule; and that the fortunes once so rapidly accumulated here as to originate the mythus of the rupee tree, were simply the results of systematic trading in some, and of systematic peculation in others. Such an idea was easily suggested by the fact, that the already known produce of India, and the silk of Cathay, and the spice of Serendib commanded immediate sale, and enormous prices in the markets of the West; that the private trade of the factors bore a very respectable proportion to that of their Hon'ble Masters; that rajahs and dewans were thickly sprinkled over the land; and that nuzzeranas were legal and weighty in amount, and fine in carat. It was difficult therefore to conceive any inducement for men to engage in the arduous and difficult task of opening new paths to wealth, when the beaten tracks offered certain affluence to moderate exertions. Yet it will be found by the historical student of that period, that in spite of all these serious temptations to engage in active political intrigue, or to confine themselves to the less harassing duties of mercantile speculation, many a clear and powerful intellect employed its energies in the honourable, though wearing, task of developing the resources of the country: and that in many instances they effected, though unaided, almost as much as has since been done with the help of refined legislation, improved science, public spirit, and the other peculiarities of the nineteenth century. The earlier adventurers to India under the Company's government (I refer to the period between 1750 and 1790) were, a large majority of them, far from being the coarse and vulgar beings it became the fashion subsequently to represent them. Often scions of ancient but decayed houses, men of liberal education, high principle, and intellectual activity, their correspondence exhibits views of commercial policy, national wealth, and the duties of the ruler which will be found far in advance of the age even in the mother country. Those who deviate into these records from the monotonous detail of bloodshed and perjury, cruelty in the strong, and treachery in the weak, which constitutes the staple of the written annals of this period, will find the perusal, what Coleridge called, "its own exceeding great reward." They will learn to estimate at its proper worth, the contemptible defence set up for some acts of Clive and Hastings, that they were suited to the time and the people among whom those statesmen moved. Pure and simple-hearted men will be seen desirous to repair their own fortunes; but anxious at the same time to be of benefit to the land which enriched them; working out their plans with patience and perseverance; oftentimes harassed by the injudicious interference of those in high places; successfully thwarted by the intrigues of others who considered their interests endangered by the out-turn of the new schemes: and not unfrequently stopped, at the very moment when their labours promised a result, by the imperative mandate of the home authorities. Sometimes retiring to repose on their well-earned affluence, they have been brought out again in advanced age, the mismanagement or dishonesty of others having ruined their fortunes; and they will be seen setting themselves cheerfully to rebuild the shattered edifice by some new expedient, the introduction of an exotic growth, a manufacture that might lessen importation from England, or one which might serve as a remittance thither.

Biographies, like these, are not interesting merely in an antiquarian light for the coming generation, but they have their utility for the present, shewing us what has been attempted afore of old time; the causes of failure, and the probability of success, if endeavours be now renewed in the same direction. The discovery and working of coal, iron, copper, lead, silver and sulphur mines; the boring of cannon; the casting of shells and shot; the glazing of earthen pottery; the manufacture of porcelain ware; of soda and potash; of salt; the introduction of mahogany and other plantations; sugar; cotton; the establishment of fisheries at the mouth of the Hooghly; the reclamation of waste lands in the Soonderbuns and in northern Bengal: each, and all, these belong to the last century—the days of Hastings, Clavering and Francis; of McPherson and Cornwallis. With the last indeed came in a spirit of anti-colonization; all encouragement to European enterprize and ability to work out the capabilities of the empire ceased. The subject being thus deprived of present interest, it is not singular that the memory of past occurrences should have fleeted by in a society constituted as is that of India. The retirement of some, the circulation of others into distant parts of the country, and the death of the rest, effaced at an early period the remembrance of what had been done: and the active duties imposed on all by the subsequently rapid extension of the British rule, left neither leisure nor inclination to the new comers to preserve the fading legends.

Having had my attention drawn some time ago to the history of mining in Bengal, and the liberality of Government in permitting access to their records having enabled me to extend my researches considerably, I propose to arrange their results in the course of two or three papers, in the hope of rescuing from "dim forgetfulness," the recollection of deeds and men already passing into the historical era. I could wish also to stimulate those who possess authentic information relative to the development of other branches of Indian industry to do so likewise, while it is in their power. Not a few of the documents registered in government offices, which would have thrown much light upon my task, no longer exist. A few short years, and what is now difficult, will become impossible.

Memoir on the Discovery and Working of Coal.

The earliest documents which I have been able to trace containing notices of the existence of coal in Bengal, bear date 1774, and they concur in assigning the priority of discovery and working of coal mines in the districts of Bheerbhoom and Pachete to Mr. Suetonius Grant Heatly. On the 11th August 1774, the Council of Revenue received the following application and proposals :—

To THE HON'BLE WARREN HASTINGS, ESQ. *President, &c.*

HON'BLE SIR AND SIRS,—I have the honour to present to you, in the name of Mr. Suetonius Grant Heatly and myself, " Proposals for working coal mines and selling coal in Bengal," in consequence of our having discovered certain coal mines in Pachete and Bheerbhoom, and I assure you, Gentlemen, that in case you will be pleased to grant us the indulgences we request, that we will endeavour to prevent all disputes with the country people, and in general to render the execution of what we undertake, subservient to every good purpose the nature of the work will admit. I am, &c.

CALCUTTA, JOHN SUMNER,
August 11, 1774. *For Sumner and Heatly.*

Proposals for Working Coal Mines and selling Coal in Bengal.

That an exclusive right be granted to us for eighteen years of working coal mines and selling coal in Bengal and its dependencies, so long as we can engage to furnish as much pit-coal as ever the Government may bespeak of us for their consumption at the market price of the time, when wanted.

That in case we discover any copper, lead, or any other mineral or metal, except iron, in digging the six mines we have discovered, that is to say, within the space included by the river Adji to the north, the border of Burdwan to the east, the river Dummooda to the south, and a circular line to the west, described from the town of Aytura in Pachete, at the distance of ten miles from Aytura, between the one river and the other, we may have the property of the same, and we agree to pay a fifth part of their produce to the Honorable Company. In case of our discovering iron ore, we will report it to the Board, and wait their pleasure on the subject.

That we will furnish the Honorable Company with ten thousand maunds of pit-coal every year, for five years to come, (if we dig so much,) at the price of two Arcot rupees, and three quarters per maund, (of 80 Sicca weight to the seer,) and after the expiration of five years; and we will annually, at the market price of the time of sale, furnish the like quantity, and we desire liberty to sell in Bengal, or export whatever quantity the Honorable Company may not bespeak of us.

That some uncultivated lands contiguous to the mines we work may be granted us, both because coal mines are known to vary and spread different ways, when the vein is sometimes lost and found again at a distance; and because we may be able to entice the labourers in future to settle on the spot, and if to this indulgence be added some contiguous cultivated lands, to the amount of about six thousand rupees rent, to be let out to us from the cutcherry of the Burdwan division, we hope it will prevent our workmen from committing trespasses or any encroachments under any pretence on other revenue lands, as they may, within our own circuit, be then furnished with provisions and necessaries by having a market to go to.

That the Government will be pleased to allow us to employ Europeans in the work we are about to undertake, on our engaging to be security for their good behaviour up the country.

That if the above six mines fail, or do not turn out of a quality for the Company's works, we may be allowed on the above terms to dig any other mines that we may discover on our pointing them out to the Government. But we do not desire to have a property in any metals or minerals we may discover, except in such parts of Pachete and Bheerbhoom, as are within the limits of the Adji and Dummooda, &c. as above described.

John Sumner,
For Sumner and Heatly.

Calcutta,
11*th August*, 1774.

On the perusal of these it was resolved,

That the Board approve of the proposals, excepting the latter part of the 4th article, respecting the farm of cultivated lands in the neighbourhood of the mines, which they are of opinion may be allowed as a present indulgence to the proposers; but to be resumed whenever their possession of them shall become liable to objections, and excepting the 6th article which is premature, notwithstanding the encouragement which they think a discovery of this kind merits from Government; yet as a precipitate acquiescence to them may be attended with ill consequences to the collections,

Resolved,—That we decline coming to a resolution until the sentiments of the Provincial Council of Burdwan have been received upon them, and that this proposal be referred to them for that purpose.

The following letter was accordingly written :—

To GEORGE VANSITTART, Esq. *Chief, &c.*

Provincial Council of Revenue at Burdwan.

Gentlemen,—Accompanying we transmit you copy of some proposals, which have been presented to us by Messrs. John Sumner and Heatly, together with an extract of our proceedings on the subject. We desire you will agreeably thereto, forward to us your sentiments on them. We are, &c.

Warren Hastings,
Wm. Aldersey,
P. M. Dacres,
James Lawrell,
John Graham,
Nicholas Grueber.

Fort William,
The 11*th August,* 1774.

On the 23d August, the answer was submitted to the Board.

To the Hon'ble WARREN HASTINGS, Esq. *President, &c. &c.*

Honourable Sir and Sirs,—We have been honoured with the receipt of your letter of the 11th instant. If the revenue of the cultivated lands, which Messrs. Sumner and Heatly request to be allowed, be equitably adjusted with the present farmers; if effectual care be taken, that they do not force people to work for them, nor erect Gunges in such a situation as to ruin any that are already established, and further, if the Europeans they may employ be removable without absolute and formal proof of their misbehaviour, and no protection be given by them to Ryots, who may desert from their farmers, with balances due from them on account of their rents; with these precautions, it does not occur to us that the scheme can be attended with any ill consequences to the collection. We are informed that iron is already manufactured within the limits they describe. We are, &c.

GEORGE VANSITTART,
JOHN BATHOE,
ALEXANDER HIGGINSON,
CHARLES FLEETWOOD.

BURDWAN,
The 15*th August*, 1774.

The following Resolution was passed on the Burdwan Report:—

Resolved,—That in consequence of the opinion given by the Chief and Provincial Council of Burdwan, a lease be granted to Messrs. Sumner and Heatly, upon the terms of which we have already approved, and with the following Resolutions.

First.—That they shall not compel people to work for them.

Second.—That they do not erect gunges or golahs of any kind, but be allowed only to establish bazars for the use of the people whom they may employ, and those subject to such regulations or occasional orders as the Chief and Provincial Council of Burdwan may think proper to issue.

Third.—That the Europeans or any other persons employed by Messrs. Sumner and Heatly, shall be liable to be recalled by the Chief and Provincial Council of Burdwan, without a reason assigned.

Fourth.—That they shall not receive or grant protection to any ryots who may desert from the farmers or officers of Government, with balances due on account of the rents, on penalty of forfeiting in every such instance treble the amount of the balances which shall be claimed as due from the said ryots by the Chief and Council of Burdwan.

Fifth.—That they shall at all times submit to and agree to abide by the judgment of the Board or of the Provincial Council of Burdwan, in cases referred to the said Council, without any other appeal.

Sixth.—That they shall not transfer the grant to any other persons, unless by express permission of the Board; but in the event of their abandoning the undertaking, surrender it again to the President and Council of Fort William.

Ordered,—That the Secretary do transmit a copy of these Resolutions, together with our former Resolutions of the 11th instant to

Messrs. Sumner and Heatly, and that he do inform them of our acquiescence to their proposals on the terms mentioned in our Resolutions.

On the 4th October, the matter came again before the Board.

To Mr. RICHARD SUMNER,
Secretary to the Revenue Department, Fort William.

Sir,—We have been honoured by the Board's answer, transmitted by you on the 24th August in respect to our proposals offered the 11th August, and we have now to request such orders as may be judged proper to the Council of Burdwan, and to have a grant (for working the coal, &c.) to the names of Sumner, Heatly, and Redfearne, as we all three are proprietors, and this is our firm. Moreover, we hope that as the time for the despatch of the ships is at hand, the Board will be so favourable to us as to represent our discovery to the Honorable Court of Directors, as their sanction will be a great encouragement to us in the work we undertake. We are, &c.

Calcutta, J. Sumner,
30th September, 1774. S. G. Heatly.

Order.

Agreed,—That they be admitted joint proprietors, and that the following letter be in consequence written to Burdwan :—

To GEORGE VANSITTART, Esq. · *Chief, &c. &c.*

Gentlemen,—Having thought proper to grant to Messrs. Sumner, Heatly and Redfearne, a Grant for working the coal we before corresponded with you about in the districts under your division, we, enclosed, transmit you a copy of the engagements they have entered into. We are, &c.

Warren Hastings.
W. Aldersey.
P. M. Dacres.
James Lawrell.
Nicholas Grueber.

Fort William,
The 4th October, 1774.

Ordered,—That the Secretary do transmit the necessary materials to the Company's Lawyer, directing him to prepare a Grant accordingly.

At this period the partners were employed on active service by Government; Mr. Sumner at the head of a commission, and Mr. Heatly to quell some serious disturbances at Mirzanagore in Jessore. Redfearne never took any part apparently in the coal work, and was stationed at Nuddeah. At length in September 1775, the following letter was received by the Board :—

To The Hon'ble WARREN HASTINGS, Esq.
Governor General, &c. and Council.

Gentlemen,—We have the honour to acquaint you with our having imported from Pachete about two thousand and five hundred maunds of coal, in part of the quantity which we offered to furnish the Honorable Company with, at 2/12, (two Arcot rupees and twelve annas) per maund, and it is now ready to be delivered to your order. We are, &c.

Calcutta, John Sumner,
15*th September*, 1775. *For Sumner, Heatly and Redfearne.*

Ordered,—That the coal be delivered to the Military Store keeper, and that he do report the quality of it to the Board.

The Store-keeper did not, however, furnish any report. Mr. Sumner was deputed with Messrs. Pye and Adair to examine the Hidgellee salt accounts, which very fully occupied his time. And Mr. Heatly was Collector of the united districts of Ramgur, Palamow, Chota Nagpore, and Gautkondory, where he had small leisure for speculations. In November 1777, both having returned to the Presidency, they renewed their endeavours to carry out the work.

To The Hon'ble WARREN HASTINGS, Esq. *&c. &c.*

Gentlemen,—I request the favour of you to order two thousand maunds of pit-coal to be received into the Honorable Company's stores. This quantity is a part of what has been dug out of mines at Pachete by the discoverers, and it has been sometime laying in Calcutta. I am, &c.

Calcutta, John Sumner,
15*th November*, 1777. *For Sumner, Heatly and Redfearne.*

Ordered,—That the two thousand maunds of pit-coal be delivered to the Military Store-keeper, and that he be directed to receive charge of it.

Ordered,—That Messrs. J. Sumner, &c. be advised accordingly.

To MAJOR JOHN GREEN, *Commissary of Stores.*

SIR,—Agreeable to the directions of the Honorable the Governor General and Council, I request you will please to receive into the store two thousand maunds of pit-coal, which has been sometime since imported into Calcutta by Messrs. Sumner, Heatly and Redfearne. When you have received the same, you will please to inform me of it. I am, &c.

FORT WILLIAM, GEORGE LIVIUS,
19*th December*, 1777. *Military Store-keeper.*

Major Green on the receipt of this letter, addressed Mr. Hastings on the quality of the coal not being fit for the purposes for which it was required by Government, and on the 24th December, Mr. Hastings brought the matter before the Council.

The Governor General lays before the Board, the following letter delivered to him by the Commissary of Stores, addressed to him by the Military Store-keeper, and submits to the Board the propriety of ordering, that the coals in question may be first examined and reported fit for use by the Commissary of Stores before they be received, in consequence of the resolution passed on the 18th August 1774, and that if they should not appear to be fit for use, that the Military Store-keeper be directed to return them to the proprietors.

The letter referred to is Livius's. The Board agreed to Mr. Hastings' proposal, and it was " *Ordered,*—That the Commissary of Stores be directed to examine the coals, agreeably to the Governor General's proposition." The report was soon sent in.

To THE HON'BLE WARREN HASTINGS, Esq. *&c. &c.*

HONORABLE SIR AND SIRS,—According to your order of the 24th December 1777, transmitted to me by your Secretary, I now enclose a report of the coal furnished by Messrs. Sumner, Heatly and Redfearne, compared with sea-coal sent from Europe. I have, &c.

FORT WILLIAM, JOHN GREEN,
20th January, 1778. *Commissary of Stores.*

A report of the trial made between the British sea-coal and the country coal furnished by Messrs. Sumner, Heatly, and Redfearne, Fort William, the 13*th January*, 1778.

Country Coal, one maund.

Two welding heats were given to fifteen seers of iron, one foot long, two and half inches broad, one and half inch thick. The first heat required thirty-seven minutes, the second with the same fire and the remainder of the coals was sixteen minutes.

N.B.—It burns away very quick, the refuse is nothing but clinker slate and dirt, without the least remains of cinders or clean ashes, and it wastes the iron very much. Yet these coals are far preferable to those sent for a former trial.

British Sea Coal, one maund.

Two welding heats were given to fifteen seers of iron of the above dimensions. The first heat required thirty minutes, the second heat five minutes, with a quantity of coals remaining sufficient to have given two more heats.

N.B.—It is plain from this trial between the two sorts of coals, that with one maund of the British, the same work may be performed that can be done with two maunds of the country, in much less time, and with not near so great a waste of iron.

JOHN GREEN,
Commissary of Stores.

The Government resolution in consequence of the report, closes the official correspondence of this period.

Ordered,—That the Military Store-keeper be directed to return the coal to the proprietors; but that they be informed, the Board will give them all reasonable encouragement in the prosecution of their undertaking, and that they have no doubt from this trial of their meeting with good coal, if they will be at the trouble of searching deeper for it, as this appears to have been gathered only from the surface of the mines.

Mr. Sumner retired at this period to England. Mr. Heatly alone remained in the neighbourhood. Tradition current in our family relates, that he brought out regularly-bred miners from Europe, and local tradition, according to Mr. Jones, confirmed the fact of Europeans having been engaged in the work, but carried off by a destructive fever. The certainty of a market was however gone, and the exertions of the proprietor became consequently less energetic. It happened singularly enough, that at the very time Government declined taking coals of the quality sent, new purchasers suddenly appeared on the very spot. In December 1777, Messrs. Farquhar and Motte addressed Government to be permitted to bore cannon for them, and to cast shot and shells, in a memorial which I shall have occasion to notice in a future paper. It has the following passages:—

" After having obtained the best information in our power, we are " of opinion, that the pergunna called Jerriah, lying between the rivers " Dummooda and Burraker in the province of Pachete, is the fittest " situation for the iron works. The river Dummooda is navigable as " high as that place. It abounds with iron ores, and has the singular " advantage of being contiguous to the coal mines of which Messrs. " Sumner and Heatly have a grant." Another passage runs thus: " By this article, however, we have no idea of prejudicing the rights of " Messrs. Sumner and Heatly, who you know, Gentlemen, have the " exclusive privilege of working the mines of coal or of any mineral or " metal, iron excepted, within certain districts of Beerbhoom and " Pachete."

It is not probable, however, that Mr. Farquhar (known subsequently as the purchaser of Fonthill Abbey from Beckford,) proved any very profitable customer to the mines. Disease and death thinned the number of Europeans employed on them. Government began to see the impropriety of permitting their revenue and judicial officers to engage in farming speculations, and the orders of July 1781, prohibiting the lending of money on such accounts, was intended as an intimation of their opinion to the service. Mr. Heatly was now appointed to the chiefship of Tirhoot and Purnea, which precluded all personal superintendence on his part. I can trace nothing more at present of his subsequent connexion with the mines. As the iron mines continued to be worked long after, he may have let the coal mines to Mr. Farquhar. If not, the well known economical disposition of the latter makes it exceedingly probable, that he availed himself of the "singular advantage of contiguity" to carry them on for his own benefit, without hindrance on the part of the proprietor.

Independent of the want of a regular market, another powerful cause came into operation a little after, to repress the energies of private speculators.

I have said that Lord Cornwallis brought out a disposition systematically opposed to anything like colonial independence. Smarting under the humiliation inflicted on him by the Americans, he undeviatingly discouraged colonization. No plan which tended to make India a self-dependent state met his approbation, and at no period of the empire here do the records exhibit such a bareness of projects for developing the resources of the country. Under such auspices, it was not to be hoped that either the original proprietor or other individuals would attempt the resuscitation of the mining project, and accordingly in a short time the "young forgot it, and the old had died." Round its history grew

> A daily darkening pall: it sank subdued,
> In cold and unrepining quietude.

A brilliant career was opened to Mr. Heatly whose social qualities, and American-royalist connexions, had made him a personal favorite with Cornwallis, and his time was fully engrossed by it.

It has been said before, that Mr. Heatly was appointed Collector of Ramgur and Palamow in 1775, a situation he held till December 1776. During this period, he was employed in examining the resources of the country with a view to its settlement. Warm with the affairs of his Bheerbhoom coal mines at the very time, I think it is hardly possible that he could have overlooked the mines of coal in Ramgur and Palamow, although the troubles which demanded his vigorous efforts for their settlement may have prevented him from devoting much attention to them. He applied for a surveyor to complete a map of the several districts under his charge. Lieut. Ranken was, at his request, appointed and prepared a map, which yet exists at the Surveyor General's Office. It does not mention a word about the existence of coal, and I am therefore inclined to attribute the notification of a coal mine situated on the river Coyle, a little below Palamow, to Mr. Heatly, who was on intimate terms with Rennell, then Surveyor-general. Rennell's map of Behar, dated 1779, announces the fact, and Arrowsmith has only copied it into his Atlas from Rennell's.

From this period there is a wide gap. In Williamson's "Wild Sports in the East," (an admirably characteristic work, published in England in 1808, and pretty nearly as unknown now as the times he delights to paint were in his,) there is an incidental allusion to coal. It occurs in pages 7 and 8, Vol I.

"Cooking is carried on in the open air by means of embers; coals "being unknown in India, except in the Ramgur country, where the "Soobanreeka river runs for some miles through a mine of excellent "quality. The country being extremely mountainous, and no navigable "river within at least a hundred miles, though small streams abound, "added to the vast abundance of fuel, occasions that valuable commo-"dity to be neglected. The India Company indeed find it easier to "send coal from England, as ballast, to their arsenals abroad, where "quantities are occasionally used in fusing metals for casting ordnance."

It was singular enough, that at this very period the India Company *did not* indeed find it easy to send coal from England. In a general letter, dated 8th April, 1808, paragraph 24, they point out to the local Government the enormous expense to which they were subjected by the exportation of coal to India; wishing to know the purposes for which it was wanted; whether charcoal will not be equally servicable, and stating if no remedy can be devised, that they must transfer their ordnance works home. The Earl of Minto was then Governor General, and drew the attention of the Military Board to the complaints of the Court of Directors.

To Capt. A. GREENE, *Secretary to the Military Board.*

Sir,—I am directed by the Right Honorable the Governor General in Council to transmit to you the enclosed copies of the 23d, 24th, 27th, and 28th paragraphs of a General Letter from the Honorable the Court of Directors, dated the 8th April last, for the information and guidance of the Military Board. I am also directed by his Lordship in Council, to call for the sentiments of the Military Board, with regard to the practicability of substituting Bheerbhoom coal for sea-coal for purposes to which the latter is applied. I am, &c.

COUNCIL CHAMBER, T. THORNHILL.
5th Sept. 1808.

I need not quote the whole of the Board's answer. It states, that an ample supply of sea-coal is actually a saving of expense, as charcoal is inadequate to the same work; and "that the Honórable Court in their General Letter of the 12th July 1805, particularly require that this article shall be regularly indented for." This last hint seems to favour a surmise of Messrs. Sumner, &c. that they were unfairly dealt with, owing to the strong interest made by the coal contractors at home. The Board go on in their third paragraph:—

"As the Military Board have never had an opportunity of seeing "or knowing the quality of Bheerbhoom coal, they request to be "favored with a communication of any information that the records "of Government may contain on the subject of it, and in what manner "some of it may be obtained for the purpose of trial at the Agency "Yard."

It was, however, not thought worth while consulting the records of Government, and his Lordship in Council directed the Collector of Bheerbhoom to procure and forward to the Commissary of Stores, a quantity of from fifty to one hundred maunds of the coal to be found in that district, reporting at the same time for the information of the authority, any particulars connected with the object of the proposed experiment which he may be enabled to collect from local enquiry respecting the quality of the coal, and the state and situation of the mines from which it is procured. His Lordship stated as his reason for this inquiry, the desirableness of ascertaining "by experiment whether the coal of which there are reported to be extensive mines in the districts of Bheerbhoom, can be advantageously used or not, as a substitute for the sea-coal annually required from England."—*Letter from Military Department to Military Board, dated 19th September,* 1808.

On the 17th February 1809, a specimen of Pachete coal, obtained from a mine discovered near the village of Cheenacoory, close to the Damooda river, and which is stated to be very abundant, was forwarded for the above object to the Military Board.

On the 12th May following, a further communication was made to the same end, with another sample of coal, on whose qualities a particular report was demanded by Government. Certain correspondence, in connection with this sample, was also handed to the Military Board, which turned out to be of exceeding interest in regard to the former labours of Mr. Heatly. The letter from the Collector of Burdwan is the first.

To B. CRISP, Esq. *President, and the Members of the Board of Revenue.*

GENTLEMEN,—Agreeably to the instructions contained in your Secretary's letter of the 7th ultimo, and its enclosures, directing me to ascertain whether coals are to be procured in this district, I applied to Mr. Thomas Marriott, a gentleman whose long residence in this district and local knowledge, qualified him to give the best possible information on the subject. I feel myself much indebted to Mr. Marriott for the trouble he has taken, and should Government propose taking any further measures in the business, I beg leave to recommend him as a very fit person to be employed. I have this day despatched by the Dawk Bangee, addressed to your Secretary, a muster of the coals I have received from Mr. Marriott. I have, &c.

BURDWAN, COLLECTOR'S OFFICE, C. TROWER, *Collector.*
8th April, 1809.

I give Mr. Marriott's enclosures in full. This gentleman, I presume, was a son of Mr. W. Marriott, who had been a Member of the Provincial Council of Burdwan in Mr. Heatly's time, and to whom therefore the circumstances of this discovery was familiar.

"My enquiries regarding the coals have been attended with so much success, that I cannot avoid the pleasure I feel in communicating them to you. I returned from Jewszuttee the day before yesterday, and brought with me two seers of coal, which I picked up near that place out of the water, and this morning made a trial of it by burning, and find that it burns excellently, having been lighted early in the morning, and still continues. On my arrival at Jewszuttee, I accidentally met with a man who is a resident of that part of the country where the heap of coal, to which I alluded in my former letter, is lying. Upon enquiry, I found that he was well acquainted with all the circumstances of Mr. Heatly having dug the coal, and of the heap being still in existence; and as a most corroborative proof that he did, he told me that the potters at that place used it for burning their pans, &c. Pleased at having thus obtained so much information, I immediately sent off a peon with a bullock, and ordered every enquiry to be made as to the spot from whence the coal was taken. The coal which I took up from the river is doubtless a part of the heap at Mudjea. But this could not have been the case with the coal taken up by Lieutenant Delamain at the Goomea Ghaut, which is many coss above Mudjea. I have not the least hesitation in giving my opinion, that I shall be able to ascertain the exact spot of the mine, should the Government deem it worth their while to make further enquiries on the subject. I have enclosed a sample of the coal, and I shall forward the bullock the moment it arrives." T. MARRIOTT.

29th March, 1809.

"In reply to your favor accompanying the public enclosures, requiring any information I might possess regarding a stratum of coal said to exist in the vicinity of this district, I have the pleasure to state, that my enquiries on this subject have been attended with much success, to which I was fortunately guided by having previously travelled in that part of the country many years ago, in which the stratum is situated. As I presume that it is unnecessary to trouble you with a repetition of what I have already mentioned in my former letters, regarding my having seen the heaps of coal lying at Mudjea, in Pachete, on my way to Jellda in 1782, I shall only further observe, that it was entirely owing to that circumstance that I was led, upon receiving your letter, to send people to the spot, to ascertain whether the heap of coal still existed; and also to make enquiry from the inhabitants as to the positive place from whence the coal was originally brought, and by whom.

"My people returned only a few days ago, and informed me, that owing to the floods, the bank at the village of Mudjea had been cut away, and that the coal in consequence had fallen into the river, and spread in different directions to a very considerable distance; that the inhabitants, in the prosecution of their enquiries, from fear or other causes, shewed great reluctance at answering any questions. But they at last met with an aged Bramin, who informed them, that the coal had been brought by Mr. Heatly, from a place named Chenacoory, and also from a spot situated in the Jungle of Damaully. The places are represented as being within nine coss of Mudjea, on the same side of the river, to the westward. It appears to me possible, that Kissencooney, marked in Rennell's map No. 7, is the same village specified by the Bramin; because the distance of that village from Mudjea agrees nearly with the Bramin's name of Cheenacoorey, and this is more likely, as the names of villages throughout Rennell's maps are frequently strangely disfigured by the mode of spelling.

"The stratum of coal is stated to be in the bed of the river, on the verge of the river, lying in flakes, and to be very abundant. The sample of coal which I have sent accompanying is brought from below the village of Mudjea, and taken up from the bed of the river, and is doubtless part of the heap originally collected at that place. Upon inspection, it will appear evident, that it must have laid in the water for a very considerable period, as the angles are in some pieces much fretted and worn off, and in others totally destroyed. I am much vexed that my people did not proceed to Cheenacoory, as they ought to have done. I have sent them back to ascertain the veracity of the Bramin's assertion, and expect that they will return in a few days.

"I shall not presume to offer any scientific opinion as to the quality of the coal, but merely state, that on a trial, I found that it burnt extremely well, afforded a very strong heat, and leaves a residum that is very considerable, compared with the original bulk.

"Regarding the stratum of coal of which Government have received some information through the communications of Lieut. Delamain and others, I have not been able to make any discovery worthy of notice. In my way down from Shahabad in 1797 to Burdwan, I crossed the Dummooda river at the same ferry that Lieut. Delamain did, which is called the Rajeghaut, and also the Goomeahghaut, (vide Rennell's map, No. 8, Gopur). To the north of the ferry, at the distance of three or four coss, there is a brook or rivulet, by the side of which I recollect seeing a hot spring, that in some places burst with a flame and caused a strong sulphureous smell. In the vicinity of this spring a stratum of coal may exist, some fragments of which Lieut. Delamain may have picked up from the bed of the Dummooda river that runs so near to the source of the spring, distant only four coss from the ferry, and into which the rivulet discharges itself. However this may be, it is highly improbable that the coal which I have collected and delivered as a sample, can be from any stratum alluded to by that gentleman, as the ford at which he passed is above forty coss beyond the spot that I have specified.

"As incurring the expense of travelling for local investigation without any immediate prospect would not suit my present circumstances, I must confess, however my inclination leads me, I have not been induced to undertake the journey. But if the Government should deem it worth while to ascertain any further points on this subject, and employ me for that purpose, I am willing to do the utmost in my power, and trust that no objections may be made to defray my travelling charges, which I presume would hardly exceed three hundred rupees. In making this tender of my services, I cannot avoid remarking, that my knowledge as a mineralogist is very confined, and that it appears a business requiring a person well versed in the nature of coal, of which it would be uncandid not to declare my ignorance.

"I beg leave further to state, that during my enquiries regarding the stratum of coal in Pachete, I have been informed by a man belonging to Tellotoo in Shahabad, that the coal is an article well known in that part of the country by the name of *Khaurdhur*, and used there on some occasions medicinally. It is to be found at a place named Thoorah, on the southern side of the Soane river, three coss above the Coyle river. Here are also quantities of coal to be found in the bed of the Buccooah nulla, that is only half a coss from Kussyaun, a place well known, which evidently discovers that there must be a stratum. It was near to this village that Mr. Prinsep many years ago found copper, and commenced an extensive manufacture of vitriolic acid."

BURDWAN, *April* 6. T. MARRIOTT.

It appears from this letter of Mr. Marriott's, that the sample of coal sent down by him for Government, and by Government to the Board for a particular report, was part of a heap lying at Mudjea, but dug at Cheenacoorey and Damully by Mr. Heatly. Upon this sample we have the subjoined

Minute by Lieut. Col. HARDWICKE.

In compliance with the desire of the Military Board, I have the honour of making a communication on the Pachete coal, submitted to me for experiment and report thereon. In the first place I shall notice some particulars and peculiarities descriptive of the substance in question, and then give the result of the few experiments made upon it. In its appearance and some of its properties, it approaches nearer to the "bituminous oxide of carbon," known in England under the denomination of Bovey coal, than any other substance I can compare it with. In texture it is lamellar, the laminæ subject to two very dissimilar appearances, the one evidently marked with the woody fibre, and resembling pure carbon or charcoal; the other of a full shining black, opaque, very brittle, and breaking with a rhomboidal fracture, both irregular and mixing one into the other. The first rubs easily into powder, and sticks to the fingers on handling; the other does not soil the fingers when rubbed. Its specific gravity is greater than the coal here used, called sea-coal, being to that as 145.75 is to 135, taking water at 100 as the standard of comparison for both. It burns with a clear whitish flame without sparks or crackling, as coal and charcoal commonly do; emits little or no smoke, and without odour, burns for a considerable time without producing ashes, and with little change to either its form, bulk, or weight. The degree of inspissation in this bituminous substance must be very great, and the carbonic principle so prevalent, that it can scarcely be termed bituminous. In combustion, it discovers none of those appearances common to good coal; it neither runs into mass, nor forms the least adhesion one piece with another; the laminæ shew a partial separation from each other, and sometimes curl up. Its appearance after considerable exposure to heat is slaty, and the few ashes formed, and adhering to the surface, of a ferruginous brown.

Experiment 1*st.*

Two lbs. weight of this coal was exposed to the strong heat of a blast furnace in an open crucible for one hour and forty-five minutes, and lost only eleven ounces of its original weight. The last ten minutes of this experiment it gave no flame. The appearance when cold, was as stated above, with this addition, that many of the black shining parts remain unchanged, shining with a vitreous texture, and more brittle than before.

Experiment 2*d.*

In the smith's forge, I found it inferior to common charcoal for producing the desired heat for working iron: and the same bar of iron which in about eight minutes under the heat of a common charcoal fire threw off scintillating sparks from its surface when taken from the forge, gave a very different appearance after being twelve minutes in the forge heated with the Pachete coal. The bar came forth with a rather dull heat, threw off no sparks, and the iron instead of yielding freely to the stroke of the hammer, flew off in large scales from its surface; and the workmen unanimously pronounced this fuel unfit for their use.

Experiment 3*d.*

I tried it also in combination with the English coal, the result was an inferior heat to that produced from Europe coal and charcoal.

Under such demonstrative proof, I do not hesitate to express my opinion, that the discovery of this coal promises no advantage for the uses of our Blacksmiths in iron work: but for household or culinary purposes, I think it may be found very desirable. For a house in particular to burn in grates or stoves, I think it desirable. It gives heat enough for our houses in India; is free from sulphureous smoke or the suffocating effect of charcoal, and makes little or no dirt. In kitchens it will be found a desirable substitute for charcoal, if the expense of obtaining it should be less, and which must most likely be the case where the facility of water conveyance is at hand.

May 19, 1809. T. HARDWICKE.

Under such demonstrative proof, with the circumstances known to all parties under which the sample was picked up, the Pachete coal was once more doomed to be shelved.

Simultaneously with the letter dispatched to the Burdwan Collector, similar instructions had been sent to the Collector of Bheerbhoom. His answer stated, that coal had been discovered in the Zemindaree of Jerrea; that the beds were superficial, and *have never been worked, the natives being entirely unacquainted with the nature and qualities of the substance!* He further stated, that the coal was slaty and burned to white ashes without leaving any cinders: that it might be transported to Calcutta by the new road, at an expense of eighty-five Rs. per 100 maunds, but by boat during the rains, the cost would be twelve Rs. per 100 maunds.—*Letter from Mr. Suttie to the Board of Revenue, 2d June*, 1809.

The Governor General in Council, for the present suspends passing any final orders on the subject of Lieut. Col. Hardwicke's report, respecting the specimens exhibited of Pachete coal: it being the intention of Government, at a convenient opportunity, to depute a professional person into that district, for the purpose of making further enquiries into the nature and situation of the coal in question.—*6th June*, 1809.

It is necessary to say a word here of Lieut. Delamain's discovery, not only because it is mentioned by Mr. Marriott in his letter, but because the Coal Committee have assigned to it the palm of priority in the district. On receiving the letter from Government, dated 19th September, stating the orders to the Collector of Bheerbhoom, the Military Board returned a reply on the 27th, saying, that *they* had been recently informed of there being a considerable stratum of coal in the bed of the Dummooda river, very near to the place where troops coming down the country are accustomed to cross that river in the Burdwan district. On the 3d January, 1809, the Board wrote again, mentioning Lieut. Delamain as the discoverer, and that he had been written to for particulars. Col. Hardwicke, who was the informant of the Military Board, had "no better evidence of the fact than is obtainable from the enclosed note from Mr. Moreton." The enclosed note ran thus:—

"I remember to have seen some pieces of very fine coal in the possession of Lieutenant James Delamain, who had taken them from the bed of the Dummooda, at or near that part of it crossed by the 7th Regt. of Native Infantry on its march from the Upper Provinces to Barrackpore, some four or five years ago. I am likewise informed by a gentleman, who has resided in the district of Burdwan, that he has frequently taken up pieces from the bed of the river at a place about five or six coss above the Civil Station, and if I am not mistaken, you will find some particulars on this subject in a work lately published, and denominated "Wild Sports of the East."

W. MORETON.

On the 24th January, 1809, Lieut. Delamain sent in his explanation.

TO LIEUT. T. MADDOCK, *Assistant Secretary to the Military Board.*

SIR,—In reply to your letter, dated the 3d instant, I request you will state to the Military Board my regret, that the specimens of coal which I had by me, have in the course of moving, been all lost.

It may afford, however, some slight guidance to mention, that I took the pieces of coal out of the Dummooda river, when the 7th Regiment marched down in December 1802, at the first ford between the village of Gomea and Angbella, (for we crossed it twice). The fragments though numerous, were all small, and strewed about immediately at the ford. As I did not burn any of it, I could not ascertain whether it were of a good or spurious species. It seemed however of a slaty structure, harder than the common coal, soiling the fingers but little when rubbed, and the colour approaching to grey. I am sorry that no opportunity has offered to enable me to give the Military Board the slightest information relative to the stratum of coal in Burdwan.

I am, Sir, &c.

KISSENGUNGE,
16*th January*, 1809.

J. DELAMAIN,
Lieut. 7th Regiment.

Lieut. Delamain's discovery therefore was confined to picking up some pieces of coal from the bed of the Dummooda in 1802, twenty-eight years after Messrs. Heatly and Sumner had imported four thousand maunds into Calcutta from the district, and while large heaps from their mines were lying about the country, their origin being familiarly known to the inhabitants. It is however interesting to see, that this discovery of Lieut. Delamain anticipates that of Col. Shelton years after, as the locality is precisely the same—the ford of Angbella, on the Benares road.

In 1814, under the spirited administration of the Marquis of Hastings, the slumbers of the Military Board were once more disturbed. Referring to the suspension of final orders on the 6th June, his Lordship stated his anxiety to ascertain beyond a doubt, whether the coal of India was of a quality calculated for the purposes of the forge. So far from being discouraged by the results of previous experiments, he considered them to afford a strong presumptive proof, that there is coal here well calculated for military purposes; that surface coal may be expected to fail here as in England, where some of the excavations reach the depth of 205 yards before proper coal is met with; that a qualified person will be despatched with the requisite apparatus, as soon as possible, to any spot the Military Board think the best, suggesting Cheenacoory to their consideration.

The Board replied, that their information was too limited to permit them to hazard an opinion; suggested the Collectors of Pachete and Burdwan as the best authorities, and recommended that the person to be deputed should examine the district before commencing his boring, and submit his plan of arrangements and details to Government for their consideration.

It was well known at this time, that Mr. Matthew Smith, an eminent shipwright in Calcutta, used the Pachete coal to a large extent in his forges. To him therefore Government applied directly for information. His answer is dated 14th March 1814. He states, that he has never been to the spot, but is told that it is Jarrea Cottra, about thirty coss from Bancoora; that the coal is from the surface, therefore too slaty and bituminous to answer every purpose of the forge; that even now he met occasionally with very good coal, and was sure that if they dug deeper, much better could be obtained. That he procured it for little more than the cooly hire, or eleven annas the cist, and had imported several thousand maunds, which he used in combination with charcoal. Mr. Smith also stated, that he obtained nails from the same place, manufactured from the iron ores of the neighbourhood with the aid of the coals; concluding with recommending Mr. W. Jones to the notice of Government as a person conversant with mines and collieries, and one "who from his great knowledge of mechanics, could soon ascertain if better coal could be found lower in the earth."

Mr. Jones, who had never been in the district before, was accordingly deputed by Government to examine it on an allowance of 600 Rs. a month. Meeting my father occasionally in town, he soon learnt all Mr. Suetonius Heatly's exertions in the working of coal, and was directed to the various sources of information. On his return, he mentioned that the remains of Mr. Heatly's works were distinctly visible, that the natives knew their origin, and stated them to have been conducted by Europeans, who fell a sacrifice to a pestilential fever. It is not therefore very creditable to Mr. Jones, that both in his papers in the Transactions of the Asiatic Society, as well as in the official correspondence which he held with various Government officers, not a single word alluding to any labours prior to his own is to be found.

From the time of Mr. Jones, the question of the value of Bheerbhoom coal has been settled, thanks to the energy of the distinguished nobleman, who then directed the councils of India. The labours of later discoverers will be found in the reports of the Coal Committee in sufficient detail. I have already sufficiently trespassed in length, having been, to speak in the quaint language of Williams' Natural History of the Mineral Kingdom, "really concerned for the honour of the coal, "and as I reckoned the subject my own, I wished therefore to be its faithful historian."

Memorandum on the usual Building Materials of the district of Cuttack, forwarded to the Museum of Economic Geology, with a set of Specimens. By Lieut. RIGBY, *Executive Engineer, Cuttack Division.*

Sandstone.

No. 1, called by the natives *Kondah,* found at Killah Mootree on the Mohanuddee, about ten miles above Cuttack, little used in the principal parts of buildings, but in constant demand for cornices and screen-work surrounding the roofs of the natives' houses. The stone is cut from the hills as wanted, and the simplest tools are used for that purpose, small or large chisels, according to the size of the portion to be separated. The operation is slow and laborious, and its cost is about three and half annas per yard. The yard of stone is three cubic feet; the carriage per yard to Cuttack is one and half annas.

No. 2, *(Laterite,)* called by the natives *Makrah,* used almost entirely for puckah buildings in this district; and may be had in almost every place, as it is found over a large extent of country, and may be carried in the rains to any part of the district. It is procurable in this presidency over a line of about sixty miles, running South-west from Cuttack, and is, I have no doubt, found over even a greater length in the Madras presidency. It is cut in slabs of from one to four feet in length, and to two feet in breadth, but seldom more than eight or nine inches in thickness, and is only quarried to a depth of two or three feet from the surface, as below that it is too soft for use. The mode of quarrying is simple; a channel being cut to the depth wanted, the stone is split off with a few blows of the hammer and chisel. Exposure to the atmosphere appears to harden these materials.

Soft Argillaceous.

No. 3, called *Bolemallah,* is used for the same purposes as No. 1. Brought from the Chutteah hills, Killah Durpon, cut at about four annas per yard; its carriage to Cuttack thence is, however, six annas for that quantity, which prohibits its use to so great an extent as No. 1.

Greenstone.

I have been unable to discover where this kind, (No. 4,) called by the natives *Moogney* is quarried, as it comes to the bazar only from the old buildings in the district; it is, however, supposed to have been brought from some considerable distance to the Southward. There is much of it in the Black pagoda, and the images on many buildings are sculptured from it; its price is twelve rupees per yard.

Two kinds of lime are in use in this district. The one made from shells, (Specimen, No. 5,) collected on the coast about Manickpatum, the other from *konker*, (No. 6,) found in numerous rivers in this district, but principally in Debnuddee. The former is collected at an expence of about three rupees and four annas per hundred maunds, and its cost when burnt, is about fifty rupees the hundred maunds, where the shells have to be carried a distance of eight or ten miles. The *konker* is collected at the rate of two rupees, and its carriage to Cuttack is six rupees for that quantity; when burnt, the lime stands at from seventeen to eighteen rupees the hundred maunds.

The foregoing are the principal building materials in use in this district, for bricks are little used, as the generality of the soil is unsuited to their manufacture :—

Specimens of Iron.

Iron, of the three kinds sent is procurable in the bazar in any quantity. The ore is found in the direction of the Mahanuddee river, a considerable distance (about 150 miles) above Cuttack, and is smelted there. The cost of No. 1, per Cuttack maund (150 sa.) is five rupees and eight annas; of No. 2, four rupees and four annas; and of No. 3, three rupees and twelve annas.

Specimens of Timbers procurable in the Bazar.

Timbers of the several kinds subjoined come to Cuttack in the rainy season in large quantities; being floated down in rafts as soon as the Mahanuddee commences to rise. The average size of each, as it arrives, is shewn, as also the price, but Timbers of considerably longer scantling are to be procured in the forests whence these come.

No. 1.—Koorom Timber, length ten feet, and diameter at each end one foot three inches, cost of each one rupee and ten annas, received from Killah Ungool, river Mahanuddee, distance from Cuttack 100 miles.

No. 2.—Jack Timber, length eight feet, and diameter one foot, cost of ditto five rupees; ditto ditto ditto.

No. 3.—Ghamber Timber, length ten feet, and diameter one foot, cost of ditto four rupees; ditto ditto ditto.

No. 4.—Giringah Timber, the length ten feet, diameter nine inches, cost of ditto one rupee and eight annas; received from Killah Ungool, river Mahanuddee, distance from Cuttack 100 miles.

No. 5.—Ubloos Timber, length ten feet, diameter one foot, cost of ditto five rupees; ditto ditto ditto.

No. 6.—Saul Timber, length ten feet, diameter one foot three inches, cost of ditto two rupees and eight annas; ditto ditto ditto, used as rafters.

No. 7.—Peahsaul Timber, length ten feet, diameter one foot, cost of ditto two rupees and eight annas; ditto ditto ditto.

This Timber is greatly in demand for doors, sash frames, and all kinds of furniture, &c. for which paint is used.

No. 8.—Sissoo Timber, the length ten feet, diameter one foot, cost of ditto three rupees and eight annas; ditto ditto ditto.

Takes a fine polish, and is much used for household furniture.

No. 9.—Boudhun Timber, length fourteen feet, diameter nine inches, cost of ditto three rupees and eight annas; ditto ditto ditto.

No. 10.—Kankarah Timber, length eight feet, diameter one foot, cost of ditto one rupee and twelve annas; ditto ditto ditto.

No. 11.—Dhamun Timber, length ten feet, diameter eight inches, cost of ditto one rupee four annas; ditto ditto ditto.

No. 12.—Saul Timber, Barohatty, length sixteen and half feet, and diameter seven inches, cost of ditto one rupee; used for beams, rafters, door posts, &c.

Second Report on the Tin of Mergui. By CAPT. G. B. TREMENHEERE, *F. R. S., Executive Engineer, Tenasserim Division.*

No. 3373.

From the Military Board.
TO THE HON'BLE W. W. BIRD, ESQ.
Deputy Governor of Bengal,
Fort William, 1st October, 1842.

HONORABLE SIR,—In continuation of our letter, No. 3403, dated the 16th October 1841, we have the honor to submit in original, Captain Tremenheere's letter, No. 183, dated the 27th August last, together with his second Report on the tin of Mergui, and to recommend that a copy of this Report, and also of the one forwarded with our letter above alluded to, with the specimens of tin, may be transmitted to the authorities in England, or to Professor Royle.

2d. The Superintending Engineer has reported to us, that he has received from Captain Tremenheere, three more boxes of specimens. These we have called for, and when received in this office, they shall also be forwarded to Government.

We have, &c.
(Signed) J. H. PATTON, *Chief Magistrate.*
" J. CHEAPE, *Lieutenant Colonel.*
" T. M. TAYLOR, *Lieutenant Colonel.*
" A. IRVINE, *Major.*

No. 183.

TO MAJOR R. FITZGERALD,
Superintending Engineer, South East Provinces, Fort William,

SIR,—I have the honor to forward by the H. C. Steamer *Enterprize,* my second report on the tin of the Mergui Province, and to advise you of the despatch by the same opportunity of three boxes of specimens, the contents of which are enumerated in the report.

2. I have also to report, that on my return from Mergui, I despatched by the Ship *Ann Ranken,* direct to London, a box of specimens

of the Kahan tin ore to Professor J. F. Royle, at the East India House, and forwarded by the Overland Mail to that gentleman a short account of the locality, and of the additional information I had collected on the subject on my second visit to Mergui.

3. Having consulted with Mr. Blundell, Commissioner, as to the best mode of disposing of the cleaned tin ore, which had been received from Kahan and another locality, he was of opinion, that as it is desirable the produce of the tin localities of the Mergui province should, as soon as possible, become known to English capitalists and adventurers, it would be useful to send the sample already collected, consisting of 229 viss, or 7 cwt. and 51 lbs. of ore from Yahmon, direct to the India House to Professor J. F. Royle, who will take the orders of the Honorable Court of Directors in regard to its eventual disposal. The quantity therefore, 12 cwt. and 38 lbs. in all, was shipped on the 11th instant on board the *Jupiter*, Captain T. Longridge, which has sailed for England direct. Mr. Sutherland, local agent of Messrs. Cockerell and Co., to whom this ship was consigned at this port, has most obligingly procured freight for ten boxes, containing the ore and specimens, on board the *Jupiter*, free from all charges.

I trust the Military Board will approve of the steps which have been taken.

4. In consequence of the inferiority of the Yahmon ore, its collection from that spot has been stopped by the Commissioner; but there are at present 118 viss of the Kahan ore at Moulmain, which await instructions, and more may be expected, as well as a sample of the Thabawlick tin, the most productive stream visited by me last year.

5. I beg to propose that this, as well as any further samples that may be procured, be sent in like manner to the India House, when Professor J. F. Royle will, with the consent of the Court, bring the subject to the notice of private speculators or others, who may be interested on the subject. The produce of the metal from the Kahan ore already sent, will, I should think, repay the expenses which Mr. Corbin, the Assistant Commissioner, has incurred in procuring it.

The report has been submitted to Mr. Blundell.

I have, &c.
(Signed) G. B. Tremenheere,
Capt. Ex. Engr., Tenasserim Div.

P. S.—If it should be thought advisable to send a copy of the accompanying report to Professor Royle, it would afford better information than I was able to give in my hurried communication of May last, alluded to in the 2d para. of this letter.

(Signed) G. B. Tremenheere, *Captain.*

Received from the Military Board by order of Government, for the Museum of Economic Geology of India.

Having in the 16th and 17th paragraphs of my first Report of the 31st August last directed attention to a rich deposit of Tin, existing at Kahan on the Tenasserim river, a few miles from Mergui, I have now to add the following information which has been since collected respecting this locality. Experimental operations have been in progress there since the end of April last, by order of the Commissioner, and under direction of Mr. Corbin, Assistant to the Commissioner at Mergui, with a view to ascertain the value of the spot for mining purposes, and I am happy to have it in my power to state, that these have been attended with complete success. More than eight hundred weight (8 cwt.) of clean ore of the pure peroxide of tin, ready for smelting has been collected by a gang of convicts, and was despatched from Mergui on the 18th July; this has been received at Moulmain, together with some bulky specimens from the same hill of macled crystals of tin or quartz, which in weight and in size of the crystals, surpass any thing I have seen in Cornwall or in Cabinets elsewhere.

2. In the early part of May, I proceeded to Mergui on the Steamer *Ganges*, and on the 10th of that month, visited Kahan in company with Mr. Blundell and Mr. Corbin. The survey of the hill, plan of which is forwarded herewith, was made on the following day. It will be seen therein, and by the portion of map on the same sheet copied from Capt. Lloyd's Survey of the Coast, that Kahan is one of several small detached hills upon what may be termed the Island of Mergui, formed by two branches of the Tenasserim, one of which debouches a few miles to the north of Mergui, and the other to the south, which is divided near the sea into numerous channels by flat mangrove ground. The general surface of the island itself is of level alluvial

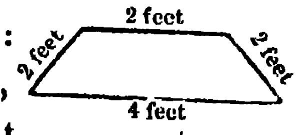
soil, from which these small isolated hills rise abruptly unconnected with each other, and detached entirely from the high granite and slate ranges which stretch along the peninsula. Except a small connected group at the town of Mergui, these have all the same exterior character, but Kahan is the only one in which tin has been found in *situ.* It occurs here imbedded in decomposed granite, consisting of a large proportion of felspar completely decomposed, termed kaolin or china clay, with quartz and mica, which appear to be its only constituents. A soft red sandstone is in immediate contact with the granite.

3. Along the same line of coast, in the southern part of the Malayan peninsula, in the provinces of Malacca and Johore for instance, the tin localities are similarly situated in small detached hills, having no apparent connection with the main ranges, and the ore is procured from a mixture of quartz, gravel, and china clay, which in description very much resembles the surface soils at Kahan. At Mergui, there is evidence of the destruction and denudation of granite hills, and of a considerable wash and deposit of debris from the eastward towards the Coast. The small cantonment there stands on the highest of a group, composed entirely of rounded fragments of quartz and sandstone, identical with that which touches the bed of decomposed granite at Kahan, with scales of mica, white felspathic clay, and likewise containing tin, which has been washed out of the gravels near the town, and from similar gravel hillocks in the neighbourhood which fringe the sea border. Localities of stream tin near the Coast south of the mouths of the Tenasserim are becoming known, and last year I penetrated to a range of hills about twenty miles from the Coast, consisting exclusively of granite, from the debris of which tin was obtained. I am for this reason inclined to think, that many of the small isolated hills before mentioned, as well as others in the low ground to the southward, will be found to consist, like Kahan, of nuclei of granite, containing tin, which have resisted the course of events, and have been left like islands in the alluvial plain between the high ranges and the sea.

4. The Kahan hill is 1921 yards in circuit at base, having a general direction of north-east and south-west; its highest points, C and F, are not more than 150 feet above the level of the surrounding rice fields.

There has been more abrasion, and the slope is more gradual on the eastern face of the hill than on the west; the debris on the east slope being evidently from the disintegration of the granite and adjoining sandstone rock, from which tin may at this day be plentifully procured a few feet below the surface. Some very rich specimens of the mineral were taken from a pit dug by the convicts about five feet deep at the point C in the plan. This face of the hill, as well as the north-east and south-west extremities near the base, have been dug into pits by the Burmese in former periods, and washed for tin in several places. Near the two last points, there are distinct traces of tanks which have been used for washing and separating the ore; the ground is seen there, and along the eastern slope, strewed with glittering plates of mica nearly an inch square, and covered with remains of the soft granitic matrix from which the ore has been extracted. A few persons now at Mergui were engaged here in tin works under the Burmese Government, and Mr. Corbin has ascertained from them, that those who understood the work, and laboured ten hours a day, collected one and a half viss of clean ore per man; but a very rich vein was not unfrequently met with, from which more than double that quantity could be obtained in the same time. No machinery was used, and the tin was procured by surface workings only. The produce, or clean peroxide of tin, was sold on the spot at the rate of five, or five and a half ticals of silver for ten viss of ore, which yielded on an average seventy per cent. of metal. The metal was at that period selling in the bazar at 100 ticals of silver for 100 viss of tin. There are 100 ticals in a viss, and 100 viss = 363 lbs. avoir.

5. On arriving at Kahan, we found that the working party had re-opened the bed of ore at the spot at which I found it last year, on the east face of the hill, marked A in the plan. At this spot, which is fifty-five feet above the level of the rice fields, and 600 feet horizontal distance from the foot of the slope, a pit twelve feet deep had been dug, the lower part of which was sufficiently roomy to allow a man to work easily with a pick-axe. The pit was an irregular four-sided figure of the following shape and dimensions: the three short sides being innermost next the vein, and apparently comprising its total thickness at that point, as far as could then be ascertained. All the three sides and the



entire depth of the pit consist of decomposed granite full of small bunches and strings of tin ore, of varying length and thickness, composed of crystals of the pure peroxide of tin, aggregated loosely together, and easily separable from the matrix in which it is imbedded. This is extremely soft and friable, and I was able with the sharp edge of a Burman *daw*, to cut down the sides of a pit, and expose fresh bunches of ore at every stroke. It is also remarkable for the large scales and crystals of mica it contains, the plates of which are readily separated, and for the abundance and whiteness of the kaolin or decomposed felspar of which the mass is chiefly composed, and to which the quartz appears to bear but a small proportion. Red sandstone touches this decomposed granite, and in the pit alluded to, looks like the enclosing rock of a vein, which is only slightly inclined from the vertical. A good sample of the ore had been collected here, and some rich specimens, shewing it in the matrix as taken from the pit.

6. The convicts had also been occupied in sinking pits near the base of the hill in other places, and had succeeded in obtaining at the north-east extremity, at the point C, some very rich specimens of the ore imbedded in material similar to that above-mentioned, angular as before, and apparently from another part of the vein, or very near it. This was afterwards placed beyond much question, for at the point B at the south-west extremity of the hill, and 280 feet from A, but on the reverse slope, the vein was again exposed to the day by a few hours' digging, and tin collected while we were there. This point is 43 feet above the level of the new fields on the west, at 550 feet horizontal distance from them, and the Burmese had worked there about 20 years ago, as was apparent by the washing tank situated on the level ground near it. It will be observed on the plan, that the points A, B, C, turn out to be in a direct line; A and B correspond very closely, both in substance and in elevation, and are doubtless part of the same vein, or mass of tin-bearing rock; and it seems probable, that this will be found to extend near the surface along the whole length of the hill, or 600 yards, accessible by mere pit digging, or by a straight gallery throughout its whole extent. It has been seen in thickness three and half feet, and in depth twelve feet; but its entire breadth and depth is, in the present stage of the workings, involved in some uncertainty, and can only be ascertained by mining operations systemati-

cally conducted. The upper decomposed portions of granite which have been exposed to view at the surface appear but indications of a most valuable repository of tin. The sandstone in contact with it is highly inclined to the horizon; and holds no water, but this is procurable within three or four feet of the surface, at the base of the hill, and could be easily raised for washing the ore by means of a Chinese wheel, or by the chain and rag pump, or by any simple process. The hill itself is not ten minutes walk from the main river, and a tidal creek touches its south-west extremity near B, and another, the north-east, at C, by either of which the produce of a mine can be carried away at high water. The northernmost creek is accessible by large boats to within 300 yards of the base of the hill.

7. On June the 15th, Mr. Corbin writes, that two pits had been sunk to the depth of eighteen feet on the ridge to the left of the small pagoda, between the points B and A, in which the stratum was found to be very thick and rich in tin. A pit near the pagoda itself had been sunk to nearly the same depth, and a very good thick stratum of tin soil found. Another on the east face, half way down the slope from A, where work had been formerly carried on, had also produced some very good ore; but as the ground had been much burrowed in former times, the surface soil was not very safe. Mr. Corbin on the above date, despatched to Moulmain eighty viss of the clean ore, which has been since received. On the 18th July, this gentleman informed me, that owing to heavy and incessant rain for fifteen or twenty days successively, the whole of the pits having no artificial support, had fallen in, before which however 170 viss more of cleaned ore had been collected, as well as the large specimens before alluded to. These are specimens of great weight and richness, consisting of large macled crystals of tin on quartz, and contain more tin in proportion to their bulk, than any specimens I have before seen. The largest which measured about fourteen inches square by twelve deep was so heavy, as to require some exertion to hold it steadily in both hands. Mr. Corbin had directed the whole of the upper soil at the pits on the ridge between B and A to be removed, and the convicts are still engaged in collecting tin from them. The stratum of tin soil, he says, is exceedingly thick here, he has ascertained it to be upwards of twelve feet. It is found, Mr. Corbin states, immediately "below the

sandstone rock, and consists principally of quartz and mica with apparently a small proportion of the sandstone, giving it a reddish colour: in some spots where the mica predominates it appears dark yellow; in this the ore is found scattered in masses; but lower down, it assumes the general form of whitish clay, where the ore is very little seen but in washing. The hill in this neighbourhood was in former days much burrowed, a pit with short galleries being met within a very few feet."

The following is a list of specimens accompanying this report, which are illustrative of the produce of Kahan :—

No. 1.—A box containing about twenty-one viss of clean ore of the native peroxide of tin.

No. 2.—Specimens of various sizes, not selected for their richness, but shewing the mode of occurrence of the tin ore in small strings and bunches, imbedded in the matrix of decomposed granite; some of these consist of nearly pure kaolin or soft felspar: in others mica and quartz predominate.

No. 3.—Specimens of pure kaolin, from the upper part of the excavations at A and B.

No. 4.—Specimens of macled crystals of peroxide of tin or quartz taken from a pit D, between B and A: with this several similar and larger pieces were found in the loose soil at the bottom of what was apparently an old Burmese shaft, and though Mr. Corbin writes, on the 9th of August, that no more had been met with, it appears from the extreme richness of the specimens, to be a valuable indication of what may be found at greater depths than have been hitherto penetrated. They existed probably in a cavity of the granite mass, before it was disintegrated by atmospheric causes, and wherein the large crystals of quartz and tin were deposited.

8. Ore rich in tin has now been found at seven different parts of the hill, chiefly in the line B A C, but near A, at more than 100 feet to the east of this direction; and Mr. Blundell, who has just returned from Mergui, informs me, that Mr. Corbin is pursuing his excavations to the westward of this line towards the highest part of the hill, and that the farther they proceed in this direction, the richer the ore becomes. This is scarcely, therefore, the character of a vein of ore, but may be more properly termed a bed of decomposed granite, containing tin in great abundance, in small bunches and strings throughout.

9. The mode of occurrence of the ore here more nearly resembles that of Banca, than any of which I am informed. The matrix in which tin is found at the latter, is said to be somewhat harder than that of Kahan, and to require pounding or stamping before it can be separated effectually; but the situation of the ores are, I understand, very similar. Mr. O'Reilly, a gentleman now residing at Amherst, was permitted by the Dutch authorities a few years ago to visit the Banca mines, and has described to me, that the matrix and ore are there dug out of pits in the face of a hill not 300 feet high, and that after being pounded, it is brought within the action of a stream of water, which is led from wells and a small spring on the higher levels. No machinery is used, but the Chinese miners penetrate after a time to a bed of solid silex, where the tin is lost altogether. Mr. O'Reilly has seen the specimens and samples of tin from Kahan, and pronounces them fully equal to Banca tin, and that the grain has precisely the grey glittering appearance, when held to the light, by which the Chinese miners distinguish good ores.

10. In addition to the sample of eight cwt. of clean ore collected at Kahan, 176 viss, or more than five cwt. have peen received from near Yahmon, a conical and isolated hill in the Nunklai district, on the opposite or south side of the Tenasserim, and about a day's journey by water from Kahan, bearing south-south-east from Mergui, distant about twenty miles. The ore is found here as stream tin, in tidal creeks, about three miles from the hill, its colour darker than that of Kahan, being nearly black, which is caused by a mixture of Wolfram sand, or Tungstate of iron.

11. Of this locality, Mr. Corbin writes to Mr. Blundell on the 24th of April: " The following morning we proceeded from Kahan to " Yahmon in the Nonklai district, where we arrived at 5 P. M., it having " taken four and half hours hard pulling to get there from the Kywai " Kuran village, and examined one of the localities, (that which had " been worked during the Burmese Government); here the soil was " rich in ore. The next morning we visited another place in a different " Nullah, a short distance from the former, where also the tin appeared to abound; but the Chinese objected to the two last spots, in " consequence of the want of a command of running water, for they " make a decided objection to wash out the soil by hand. Of the three

" places, they gave the preference to Kahan; one of their reasons in " favor of this was, its propinquity to the town and the main river, for " procuring their supplies. The tide flows to both of the Yahmon sites " where the Nullahs appear to terminate, and during the spring tides " the water recedes to a considerable distance from where I landed, " leaving the Nullahs dry at this season; their sides are muddy, but in " the middle is a small clear gravelly space in which tin ore is found. " The Chinamen say, this ore is precisely of the same description as " that of Kahan; but from the accounts of the natives, it always sold at " ten per cent. less."

This inferiority, which is marked by its selling price, is owing to the mixture of Wolfram sand, before mentioned, which, from being very nearly of the same specific gravity as tin, it is difficult to separate. It has likewise a strong sulphureous smell, and would require to be roasted before it is put in the smelting furnace. The presence of tungstate of iron with stream tin in the Mergui Province is very common; it has apparently an extensive distribution in some of the minor ranges near the sea, and becomes mixed with the tin in the beds of streams, after both are detached from their original sites. Nearly all the specimens of ore brought by Mr. Corbin last year from Malewan, on the Pakchan river, contain it in such abundance as would most likely interfere materially with the profitable working of tin in many of those localities. It was not present with the stream tin procured last year from the Thabawlick, the Thengdon, and other rivers east of the town of Tenasserim.

12. Two hundred viss of the Yahmon tin ore, in addition to what has been already mentioned, is expected by the next opportunity from Mergui; as well as a sample from the Thabawlick river, which I visited and reported on last year. Some Malays have been there collecting the ore, and have agreed to supply it at half the selling price of smelted tin, or about forty-five rupees per 100 viss.

An analysis of the Yahmon ore gave per cent.

Of Metallic Iron, ...	4.69
" Tungstic Acid, ...	29.46
" Sulphur, ...	1.37
Earthy residue and tin not examined....	64.48
	100.00

The Kahan ore gave on analysis 0.91 per cent. of metallic iron only, and is believed to be free from the tungstate of iron and sulphur.

13. No accurate statement can be made of the probable cost of obtaining the cleaned ore at Kahan from the outlay which has been lately incurred. Convicts alone, who were before quite unaccustomed to the work, have been employed, and for this labour no cost appears. Chinese labourers, who understand the process of washing and smelting are to be procured in any numbers, and many, who have heard that enquiries have been lately on foot concerning tin, have come already from Tacopah to Mergui in search of work. They arrive in poverty, and are glad to accept the wages of common coolies in plantation work, &c. till better employment is to be had. Advances of money for subsistence, and to enable them to make the requisite preparations for getting the ore, both in tools, wheel work, troughs, &c. are only necessary for commencing operations to any extent at Kahan, or at any of the most available sites of stream tin. The wages of Chinese miners in the peninsula are said to be from five to eight dollars per month; but they would be found ready to stipulate for the payment of their labour by a certain fixed proportion of the produce. At the Dutch mines, I am told they are remunerated by 40 per cent. of the actual produce, the remaining 60 being the clear profit and property of Government, which has been found at Banca and in the Straits to be the best mode of paying them. They are in mining operations, as well as in common labour, more skilful and industrious than any class in the East with which I am acquainted. By Rule 4th, concerning grants of waste forest and jungle land, published at Moulmain on 10th May 1841, a tax not exceeding 10 per cent. is leviable on the part of Government on the gross produce of mines worked within the limits of any grant.

The freight of tin from Mergui to Penang with the present craft, (China junks,) plying between the two places, would be two rupees four annas per 100 viss of 365 lbs. Freight from Penang to China by the Penang Price Current of April last, was 55 to 65 cents. per picul.

To Whampoa about 50 cents. more than to Lintin.

From Penang to Calcutta, eight annas to one rupee per picul.

„ „ „ to Bombay ten annas to one rupee ditto.

„ „ „ to London 1*l.* per ton of 20 cwt.

The freight of the metal from Mergui to London, via Penang, may be taken at 2*s*. 6*d*. per cwt.

14. The annual produce of the Banca mines was stated by Sir S. Raffles in 1827, to be 30,000 piculs, but owing to the substitution of late years of Chinese workmen throughout, to whom the mines are farmed, for the less productive labour of the natives, the out-turn has been since nearly doubled. Mr. O'Reilly informs me that in 1841, the actual produce was 54,000 piculs, but a considerable reduction in the amount obtained from the Malayan peninsula, south of Junk Ceylon, has taken place within this period, chiefly owing to dissensions amongst the petty chiefs on the East coast. In 1835, 34,600 piculs were assigned by Ensign Newbold as the annual produce of these states, but the total amount from thence may now, I understand, be estimated at about 22,000 piculs,—and from Banca

54,000

76,000 piculs, or 4523 tons.

In this most extensive tin region, comprising the whole of the Malayan peninsula, the most extensive known repository of this metal, there is sufficient evidence collected that many convenient and valuable localities exist within the limits of our own territory. The northernmost point at which it is known in the Tenasserim Provinces is amongst the high ranges near Tavoy, where, in the Tounq-byouk valley, it has been seen by the Rev. Mr. Mason, and traces of former works observed above Kaboung and on the Talinq-guwa, twenty miles north of Tavoy. A specimen of very small grained tin from this locality has been recently brought from Tavoy by Mr. Blundell. It was washed out of alluvial soil, and stated to occur more plentifully, and sometimes in pieces at greater depths. The locality is said to be near granite hills, and from the occurrence of tin with the alluvial soils, it exists probably in great abundance in the hills themselves. To the northward of this I have not heard of it, but in Karreenee, the country of the red Kareans, on the Burmese side of the Salween river in 18 north latitude, the metal has been obtained by Captain Warwick from the natives, at the rate of about twenty-five rupees per 100 viss, who states, that a considerable quantity of tin is obtainable there at that cost by indirect barter for beads, broad cloth,

and coloured cottons. It appears by a good specimen of rolled tin stone in the possession of a native at Mergui, which Mr. Blundell has shewn me, that near the head of the Palouk river, about thirty miles north of Mergui, tin ore exists, and the specimen exhibits tin interspersed in a rock very much resembling the ore of the Cornish mines. The existence of tin in the Palouk river was known, and the late Dr. Helfer proceeded on one occasion to examine it, but owing to indisposition, was obliged to return without effecting his purpose. Between the neighbourhood of Mergui and the Pakchou river, our southern boundary, it also occurs at Bokpyeen, and in many streams near the coast, but has not been much sought for, as this part of the province is an uninterrupted jungle, with scarcely any inhabitants.

15. All the tin sites in the Mergui province are believed to be healthy. Kahan is situated on the bank of a large river, where it is more than a mile broad, and a few miles only from the sea, while the spot itself is open, and the level ground entirely free from jungle. The coal mine lately worked on the Tenasserim river, sixty-four miles from Mergui, is farther inland than any of the tin localities yet known, and the country around is clothed with jungle to the summits of the highest hills; the parties of convicts employed there from December 1840 to October 1841, were not subjected to any remarkable degree of sickness, if their daily employment at hard labour, and consequent exposure, is taken into consideration. The European overseers and mechanics under Lieut. Hutchinson were perfectly healthy, and the following Table represents the proportion per cent. of native convicts reported sick at Mergui for nineteen months successively, compared with the proportion at the coal mine during the same period.

		Proportions per cent. reported sick during the month at Mergui.	Proportions per cent. reported sick during the month in the Jungles.		Remarks.
April,	1840.	$10\frac{5}{17}$	$24\frac{4}{15}$	1840.	The number of convicts from which these proportions were determined, varied at Mergui, from 136 to 230, and in the Jungles from 94 to 204.
May,	,,	20	$21\frac{123}{137}$	,,	
June,	,,	$26\frac{6}{7}$	$27\frac{1}{137}$	,,	
July,	,,	20	$24\frac{2}{3}$	,,	
August,	,,	$15\frac{35}{61}$	$12\frac{16}{57}$	,,	
September,	,,	$11\frac{1}{59}$	$27\frac{87}{89}$	,,	
October,	,,	$11\frac{25}{31}$	$18\frac{1}{2}$	,,	
November,	,,	$14\frac{11}{81}$	$28\frac{34}{97}$	,,	
December,	,,	$16\frac{4}{37}$	$35\frac{75}{61}$	,,	
January,	1841	$6\frac{15}{74}$	$11\frac{167}{753}$	1841	
February,	,,	$3\frac{59}{117}$	$16\frac{1}{2}$	,,	
March,	,,	$9\frac{43}{73}$	$16\frac{16}{49}$	,,	
April,	,,	$7\frac{27}{39}$	$26\frac{182}{192}$	,,	
May,	,,	$8\frac{13}{39}$	20	,,	
June,	,,	$14\frac{21}{147}$	$27\frac{6}{47}$	,,	
July,	,,	$7\frac{39}{73}$	$9\frac{99}{189}$	,,	
August,	,,	$9\frac{3}{8}$	$16\frac{5}{37}$	,,	
September,	,,	$13\frac{53}{219}$	$8\frac{76}{103}$	,,	
October,	,,	$8\frac{16}{33}$	$6\frac{18}{47}$	,,	

The receipts of tin ore up to this date are,

From Kahan, corresponding with sample, No. 1.

" despatched from Mergui, 15th June	80	viss
" ditto ditto 18th July	177	,,
" ditto from Mergui 17th Augt.	118	,,
Total, ...	375	viss or 12 cwt. 24lb.
From Yahmon, corresponding with sample, No. 2		
" despatched from Mergui 18th July	166	viss or 5 cwt. 15lb
Total from both places, ...	541	viss or 17 cwt. 69lb

MOULMEIN, (Signed) G. B. TREMENHEERE,
27th August, 1842. *Capt. Bengal Engr. Ex. Engr. Ten. Div.*

(True copies,) H. V. BAYLEY,
Depy. Secy. to the Govt. of Bengal.

We have lost no time in giving this valuable report and its plan to the public, and we should add here, that the specimens have been divided; a part having been sent home to the Hon'ble the Court of Directors, and a part retained for the Museum of Economic Geology.—ED.

Notes on the Iron of the Kasia Hills, for the Museum of Economic Geology. By Lieutenant YULE, *Engineers.*

We have had much pleasure in giving with this valuable article, (not the last we trust that the Museum will be favoured with from Lieutenant Yule,) the spirited sketch, No. I. which accompanied it, but No. II. was found to be exactly similar to that accompanying Mr. Cracroft's paper on the smelting of the Iron Ores of the Kasia Hills, in Journal As. Soc. Vol. I. p. 150, and being rather graphic than of manufacturing utility, we take the liberty of referring our readers to that volume.—ED.

These notes are very imperfect, but having no prospect of opportunity to render them more complete, I am unwilling to withhold them, such as they are.

I believe iron ore is excavated at intervals throughout this great range of hills by all the various races who inhabit them, Garrows, Kassias, and Nagas, of many tribes.

The district in which these notes were taken, includes the large villages of Nongkrem and Moliem, near the banks of the Ka-umyam, or Boya Pani, about eighteen miles north of Cherra, and for a space five or six miles in length from east to west by two in breadth, exhibits old or new excavations in every hill-side. So marked an effect have these works achieved on the undulating hills which cover the country, that in many instances what must once have been like their neighbours, round, swelling knolls, appear to have collapsed and sunk to their skeletons, shewing nothing but fantastic piles of naked boulders; the earth which once bound and covered them, having been entirely washed out by the heavy rains following in the track of the miner. So numerous and extensive are the traces of former excavations, that judging by the number at present in progress, one may guess them to have occupied the population for twenty centuries. The mines are so similar, that the description of one will sufficiently apply to all. It presents to view a semi-circular broken slope of debris and boulder, on the hill side, exactly such as is described by the word *scar* used in the north country at home. A small stream of water is conducted along the slope to the site of the present

See Sketch A.

See ditto, b.

excavation. The excavators standing on one side of their work, poke out the soil from between the boulders with long poles terminating in iron spikes. The loosened soil tumbles into the stream, and is carried by it violently down a narrow channel to a point 200 yards distant, and about eighty feet perpendicularly below. Here a little post is fixed at each side of the stream, and against the upper side of these posts, little bits of stick are laid, so as to form a kind of dam, which stops the heavy particles of iron, whilst the lighter grains of soil are carried off by the rapid stream bounding over the obstacle. As the iron accumulates, sticks are added to heighten the dam, and when this is nearly as high as the bank, (about one foot), the ore, a fine black sand is taken out, the dam lowered, and the process repeated. Above the dam a man is constantly employed in turning up the channel of the stream with a hoe, to prevent the ore from sticking in the passage, and with a long hooked fork (F), he occasionally takes out any pieces of stone brought down by the current.

See Sketch C.

See ditto D. D.

See ditto e.

The ore is now removed to the washing trough, which is supplied with water by a small branch of the upper stream. The washing is performed by two women, working the ore against the stream with their feet, and occasionally turning and mixing it with a hoe. It is then put in a heap to dry, and washed again. This washing I was told is repeated four times.

See ditto G.

The ore is then carried to the smelting house. The charcoal used (at Nongkrem) is of all sorts. The best is said to be that made from a small species of oak common near the Boga Pani, and from a tree called by the Kasias *dingsai*, bearing an acorn, but the leaves of which do not resemble the oak. The fir is used, because it grows at the door, but it is not approved of.

The bellows are double; formed of two-half cylinders of cowskin, and worked by a man or woman, with a leg on each swaying from foot to foot. Sometimes this employs two, as in the sketch, where the good man and his wife are at work. The furnace is about twenty inches in diameter; and the chimney about five feet high, made of clay bound with iron hoops. In the village of Sorra Rim, the chimneys are made of a fine white clay, a quantity of which was furnished to Dr. O'Shaughnessy for his experiments in Pottery.

The iron sand is wetted and placed on a shelf. At short intervals a handful of fern leaves is dipped into the sand, and shoved into the furnace, and charcoal to replenish the fire is poured down the chimney. In some villages, instead of using the fern, as above described, the ore is mixed with pounded charcoal and placed on the shelf. The person who works the bellows, at almost every other sway of his body takes up a pinch of the mixture, with a long handled spoon, and drops it into the chimney.

After an interval (which from the equal size of the masses, must be very regular, though judged by guess,) one of the workmen stirs up the mass with the poker (M), takes it out with the tongs (N), lays it on a block covered with earth, beats it with a wooden club into a sort of hemisphere, and then splits it nearly in twain with axe (O), which like most other Kasia cutting and digging tools, has a heavy-headed handle and a very acute angle. He opens the split further by the insertion of a couple of wedges, and then pitches the hot mass (P) into a trough full of pounded dross, to cool. The metal, impure as it is, is now sent to market all over the hills, and to the plains of Sylhet. The loss of iron purchased in this form is at least three parts in four. Heating in the furnace and hammering, form the only further process of purification.

The Kasia tools appear generally to be of impure iron, though their edges are often good and serviceable, being formed of steel, and welded to the rough blade. The Nagas to the eastward, though said to be much more savage in their habits than the Kasias, appear (judging from their weapons of war) to have much more skill in refining iron. The excavation is only carried on in the height of the rains, as the streams employed in their plan of washing the iron are only then full. Perhaps one year's excavation occupies only twenty days! and it may be still fewer, as the rain in that district does not come near the Cherra mark of thirty inches in twenty-four hours. From four to ten rupees annual rent is paid for a mine, where the proprietor is not the excavator. The men employed as miners receive four annas a day, and will excavate in twenty days in a good mine, the value of twenty five or thirty rupees each. Thus the statement of expense and profit in a good mine for a season of twenty days, will be as follows:—

Expenditure.

3 Men, (excavators,) at four annas for twenty days, Rs.	15	0	0
2 Women, (washers,) at one and half do. for thirty days,	5	10	0
2 Lads employed in clearing the channel, and watching the dam D. at two annas for twenty days,	5	0	0
Rent,	10	0	0
	35	10	0

Profit.

The work of three men, averaging a value of twenty-seven rupees each,	81	0	0
Deduct,	35	10	0
Profit annually,	45	6	0

The ore when washed is sold for smelting by the basket, one rupee for seven baskets, or about three maunds.

After smelting, as above described, it is generally sold in the hills by the score of pieces. At Mongkrem one rupee, or one rupee two annas a score. About a dozen of these pieces go to the maund, and at the Pundua bazar, at the foot of the hills, they sell by weight at one rupee four annas a maund. Fourteen or fifteen of these pieces are made in one furnace in a day's work, or where the work is carried on day and night, as is common in some places, from twenty-four to twenty-five in the twenty-four hours. Specimen No. 6 shews the iron in this state. It is also sold in pigs, such as specimen No. 10, at three rupees four annas to three rupees eight annas in the Cherra bazar. Of this the smiths tell me, there will be a further waste of ten or fifteen seers in the maund.

List of Specimens forwarded.

No. 1. Decomposed rock containing the ore.
No. 2. Ditto in a more solid state.
No. 3. Boulders in the ground excavated.
No. 4. Ore partially washed.
No. 5. Ditto ready for the furnace.
No. 6. Metal after smelting as sent to market (half a piece.)

No. 7, 8. Slags from the smelting.

No. 9. Dross detached by beating with wooden club.

No. 10. Metal as sold in pigs at three rupees eight annas a maund.

No. 11. Metal further refined.

No. 12. Is a specimen of slate found about twenty miles from Cherra near the Assam road. I should be glad to know any particulars of the proper mode of working and splitting slate,* and whether it is usually of better quality below the surface. This (found at the surface) does not split into plates sufficiently thin, nor sufficiently parallel.

There is, I am told, an account of the iron works in these hills by Mr. Cracroft, in an old number of the Asiatic Society's Journal. Not having access to the former volumes of the Journal, I cannot tell whether it is such as to render these notes superfluous.

Cherra Poonjee, 21st September 1842.

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* This was duly sent.—H. P.

Note by the Curator Museum of Economic Geology.—The granite has nothing remarkable about it, and the iron sand is so minutely dispersed, that it can only be traced at times by a commencement of oxidation. The boulders are of silex.

The ore is composed of minute amorphous grains of the common iron sand, remarkably equal in size, and amongst which all traces of crystallisation have almost disappeared, for it is rare to detect any thing approaching to even an imperfect crystal. Upon digesting some of the slags with muriatic acid, I find that they contain sulphuret of iron (which accounts perhaps for the inferior quality of the metal) but no titanium was detected. Minute specks of the sulphuret resembling gold-coloured mica are visible on close examination in the granite.—H. P.

Captain THOS. HUTTON *on* GALEODES *(vorax ?)*

In the 52d and 53d Numbers of the Annals and Magazine of Natural History, are two letters from Messrs. W. S. Macleay and W. E. Shuckard, relating to the occasional capture of small birds by certain species of Arachnidæ; and as the subject is one of some interest, I take the liberty of presenting you with a note long since made by me, on the habits of a large species of Galeodes, common to some parts of India, and for which, if undescribed, I would propose the name of "Galeodes *vorax.*"

My first observations on this species were made in 1832 at Mirzapore, where it is very abundant, and of large size. During the rainy season, it was my constant habit on a fine evening, to spread a sheet upon the ground near my house, upon which was placed a small lantern to attract insects.

In a very short time, two or three of these ravenous spiders would make their appearance at the edge of the sheet, but at a respectful distance from each other, and no sooner did a moth, or a beetle, or a cricket alight upon it, than it was snapped up and devoured before I could lay hold of it. There seemed indeed to be no end to the appetite of these creatures, for they continued to seize and devour every thing indiscriminately, that came within their reach, even to large and hard winged beetles, cutting them to pieces with their powerful jaws with the greatest ease. Many were the deadly fights I witnessed among these marauders, as they trespassed upon each other's beats to get possession of some newly alighted prey, and often was I obliged to kill them, in order that I too might in turn obtain some share of the booty. This species is, strictly speaking, nocturnal, though I have sometimes seen them active in the day time; they live beneath stones and in holes in the ground, and never construct a net or other trap for their prey, seizing every thing by main force, as they roam about in search of food.

Again I fell in with this species abundantly at Neemuch, where they were also sometimes of large size. One of these I kept for some time in a vessel, the bottom of which was well supplied with earth, which had been purposely hardened by pouring water on it and then allowing it to dry.

The Galeodes soon began to dig a hole, and in a very short time succeeded in making itself a subterranean retreat, in which it usually resided, seldom coming forth beyond the mouth of its den. It proceeded to dig out the earth at first with its strong jaws, cutting it away in a circle, and having thus loosened the soil, it gathered it together into a heap with its anterior palpi and threw it out behind, as a dog does in scratching a hole. When it had by this means succeeded in excavating a hole sufficiently large for it to enter, instead of throwing out the loose earth as at first, it gathered a quantity together, and surrounding or embracing it with the anterior palpi, shoved the load by main force before it up the mouth of the cave, and then returned for more. Having completed its task, it remained for a few days stationary and refused to feed, although previously it would devour several insects at a meal, and even small house lizards. I now perceived that it was a female, the ova being distinctly visible through the skin of the abdomen, which was much distended.

The ova were deposited in the cave, to the number of more than fifty (50,) the parent remaining motionless amidst them. In the course of a fortnight, these, which were of the size of a largish mustard seed, and of whitish hue, were all hatched.

The young are at first motionless, and appear devoid of animation until the period of three weeks has elapsed, at which time they cast the first skin. Their colour, which up to this time was pure milky white, now gave place to a faint tinge of pale brown, and the jaws and palpi became deep brown.

The young ones now threw off their lethargy, and began to move about and occasionally sallied forth from the den, but instantly retreated on the slightest appearance of danger. All this time, however, they took, apparently, no food whatever, and yet they continued to grow both in size and activity.

It was indeed very interesting to watch the motions of the parent at this season. From the general bad and ferocious character which the spider tribe bears, I fully expected to see the parent, at the first craving of appetite, commence an attack upon her own family, and devour them; but the all-wise Creator has endowed even this ferocious spider with that most powerful feeling—maternal love; and thus is the Galeodes, the very tiger of the insect world, subdued at this period into the anxious and tender mother. Placing herself in front of the aperture of the cave, she seized and examined between her anterior palpi, every thing that entered. I tried repeatedly to arouse her anger by thrusting in straws, hoping to make her forget her good behaviour, but all in vain, for though she bit and pulled at the straws in evident anger, not once did she turn upon her offspring, although crowding round and crawling over her very body. I then threw in some beetles and flies, upon which she vented her fury by speedily devouring them, and I thought by this means to play her a trick. Accordingly, I withdrew two or three of the young ones from the cave, and threw in alternately a beetle and a young Galeodes, thinking to deceive the parent, and make her in the blindness of her fury, *commit infanticide.* But nature was not to be thus deceived; the unfortunate beetles were instantly seized and devoured, but the mother knew her offspring, and drew them into the den without the slightest injury; the beetles were gathered into her jaws, but her own offspring were merely seized between the anterior palpi, and allowed to pass on unhurt.

This whole family, much to my regret, effected their escape from the vessel in which I kept them, which being of glass and deep-sided, I thought sufficiently secure, and therefore left uncovered.

The Galeodes, however, being furnished with a *retractile sucker* at the ends of the anterior palpi, had contrived to crawl up the side of the glass, and make their escape. I succeeded more than a month afterwards in recapturing the old one in the same room, but her offspring I never again saw.

This species is extremely voracious, feeding at night upon beetles, flies, and even large lizards, and sometimes gorging itself to such a degree, as to render it almost unable to move.

A lizard three inches long, *exclusive of tail,* was entirely devoured; the spider sprung at it, and made a seizure immediately behind the shoulder, never quitting its hold until the whole was consumed. The poor lizard struggled violently at first, rolling over and over in its agony, but the spider kept firm hold, and gradually sawed away with its double jaws into the very entrails of its victim. The only parts uneaten were the jaws and part of the skin, although the lizard was at least five inches long from nose to extremity of tail. After this meal, the spider remained gorged and motionless for about a fortnight, being much swollen and distended.

A young sparrow, about half grown, was placed under a bell glass with a Galeodes; the moment the luckless bird moved, the spider seized him by the thigh, which he speedily sawed off, in spite of the sparrow's fluttering, and then as the poor bird continued to struggle in pain, the savage seized him by the throat; and soon put an end to his sufferings by cutting off the head. It *did not, however, devour the bird nor any part of it,* but seemed satisfied with having killed it.

On another occasion, I gave it a large garden lizard, which was instantly seized by the middle of the body; the lizard finding that it could not shake off its adversary, turned its head and bit the Galeodes on one leg, which obliged it immediately to quit its hold and retreat; this was owing to the seizure having been made too low down on the body, for in general the Galeodes seizes as close behind the shoulder as can be, in order to put it out of the victim's power to turn and bite; the lizard was allowed to escape with only a severe wound in the side, but as it lived for some days before I allowed it to run off, the bite of the Galeodes would not appear to be poisonous.

On another occasion, my friend Dr. Baddeley confined one of these spiders in a wall-shade with two young musk rats, (Sorex Indicus), both of which were killed by it.

When two of these spiders are confined in a vessel together, both endeavour to make their escape, as if conscious of their mutual danger. If in their efforts to get away they are brought into contact, the one instantly seizes the other and devours him, the victim making no struggles whatever; but if they meet face to face, both enter into a wrestling match for life or death.

They plant their true feet firmly on the ground, the body at the same time being elevated, and the two pairs of palpi held out in front to ward off the attack. In this attitude they advance and retire, according as either gains a slight advantage, endeavouring to throw each other to one side, so as to expose some vulnerable part, or form an opening for attack, and when this is once effected, the fortunate wrestler instantly takes advantage of it, and rushing in, seizes his adversary behind the thorax, and the combat is ended; the vanquished victim yielding himself without further struggle to his inevitable fate.

The same species occurs in the Bhawulpore country, from whence I obtained it when constructing the road for the advance of the Army of the Indus in 1888. It is also abundant in Afghanistan, where in all probability it is the species mistaken by Elphinstone for the *Tarantula,* which he describes as common in that country, but which I neither saw nor heard of.

The usual size of an adult specimen of "Galeodes (vorax",) *mihi,* is about 2½ to 2¾ inches long, and the body or abdomen equal to a thrush's egg. When in motion, the body is elevated off the ground, and the two pairs of palpi or feelers are stretched out ready to make a seizure; it progresses therefore solely upon the true legs, which spring from the thorax, and are six in number. The head is armed with two strong and formidable chelæ, or double jaws, answering to the long cheliform fore-arms of the scorpion; these jaws are denticulate, and the ends are curved, sharp pointed, and extremely hard and horny, of a dark brown colour. Eyes two, and placed on the top of the head between the base of the jaws; the colour generally is sandy brown, and the body soft and clothed with short mouse-coloured hairs; the limbs, and especially the palpi, are furnished with long coarse hairs; beneath these are ten obtriangular plates springing from the under side of the thigh or coxæ of the posterior legs, five on each, the inner one being smallest, the outer one largest; these are of an obtriangular form, and their use appears to be still unknown. I never saw them used to assist progression in any way.

The true legs are furnished at the end with strong hooks or claws, but the two pairs of pedi-palpi are destitute of them, the anterior pair being the largest and strongest, and furnished at the end with a white retractile sucker; this in a state of rest is withdrawn into the last joint of the palpi, and it appears to be used to assist in climbing up surfaces, or in hanging against gravity, in the same way that flies and lizards use their feet, by the exclusion of air. In seizing its prey, one pair of jaws keeps hold, while the other is advanced to cut, and they thus alternately advance and hold till the victim is sawed in two; the only sound they emit is a hissing or rustling, caused by the friction of the two pairs of chelæ, as they are advanced and withdrawn; this is only heard when the spider is suddenly disturbed or irritated.

From the tenor of Mr. W. S. Macleay's remarks upon *Mygale* and the large species of *Epeira*, which he has discovered in the vicinity of Sydney, it would appear, that although these spiders may occasionally feed upon the juices of warm-blooded animals, which accident may throw in their way, yet that their natural food consists of insects, and the fact of their killing birds at all, must be regarded as a very rare exception to the general rule of their habits; and from the above remarks on Galeodes, it will be seen that the habits of this spider in some measure corroborate Mr. Macleay's opinion, for although strictly speaking, the proper food of Galeodes consists of insects, yet when accident throws a lizard in its way, it will not fail to seize and devour it. With regard however to its preying at all upon warm-blooded animals, we have as yet no testimony whatever, for in the experiments above cited it will be observed, that although the sparrow and musk rats were easily killed by the spider, yet that it fed upon neither of them.*

Mussoorree, 21st June, 1842.

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* Should this paper meet the eye of Mr. Macleay, I may add, that I shall be happy to do my best in determining the habits and economy of any species found in my neighbourhood, if he will kindly point out his wants and wishes, and I shall likewise be happy to assist him with duplicates from my own collection. I would likewise gladly effect exchanges with any one collecting in the Islands, or on the Continent of India.

Proceedings of the Asiatic Society.

(Friday Evening, 12th August, 1842.)

The Hon'ble H. T. Prinsep, President, in the Chair.

The following Gentlemen proposed as Members were unanimously elected; viz.

Captain R. Shortrede, Assistant Surveyor Grand Trigonometrical Survey.

Brevet Captain W. J. E. Boys, 6th Regt. Light Cavalry.

R. Houston, Esq. C. S.

Ordered—That the usual communication of their election be made to the parties, and that they be furnished with the rules of the Society for their guidance.

Messrs. J. Mackenzie, and A. S. Gladstone were proposed as Members of the Society by the Hon'ble the President, seconded by the Secretary.

Library.

The following Books were presented.

Books received for the Meeting on the 13th August, 1842.

The Calcutta Literary Gleaner. Calcutta, August 1842. Vol. I, No. 4, from the Editor.

The Calcutta Christian Observer. August 1842. New Series, Vol. III, No. 32. Presented.

Abstract of the Proceedings of a Committee for the investigation of the Coal and Mineral Resources of India. Calcutta, April 1842. Two copies, from Government.

Reports on projected Canals in the Dehli Territory, Allahabad. From Government.

Sixth report of the Egyptian Society, 1842, pamphlet. From the Society.

Laws and Regulations of the Egyptian Society, pamphlet. From the Society.

The Annals and Magazine of Natural History, Vol. VIII. No. 53, Vol. IX, No. 56. Purchased.

History of British Birds, by W. Yarrell. London, 1842, part 30. Purchased.

The Secretary submitted the proceedings of the Royal Society of Agriculture and of Commerce of Caen, received by the Mail.

Ordered—That the thanks of the Society be communicated for the same.

Read the following letter from Mr. Piddington.

To H. Torrens, Esq.
Secretary, Asiatic Society.

Sir,—Having examined attentively the five books of Dr. Voysey's Notes, I beg to report, that there is in them much geological information of the very highest interest, for they principally relate to that stupendous geological phænomenon, the great trap and granite formation of Central India.

I have further to bring to your notice, that from a fragment of a report amongst the papers, it would appear that there must have been reports made by him to Government (the Supreme Government of India), from 1819 to 1824, apparently, at least, once a year.

I beg to suggest then that, as doubtless containing much matter of value, an application be made to Government for permission to examine and publish such parts of them as may be of general utility.

I am, Sir,
Your obedient servant.
H. Piddington,
Curator, Museum Economic Geology.

Museum, 19th July, 1842.

P.S.—I should perhaps remark here, that there are two *special* reports published in the Journal of the Asiatic Society for 1833; but these do not appear to me to be Dr. Voysey's official summaries of his annual labours, and from the fragment above alluded to, more I think must be found.

The Secretary, reported that the foregoing letter was, agreeably to the directions of the President, submitted to the Government, with a request that its Records may be searched for the highly valuable documents therein alluded to.

Read summary description of two new species of Flying Squirrels and of an Eagle, by H. B. Hodgson Esq. with observations by Mr. Blyth, Curator.

Referred to the Secretary for publication in his Journal.

Read a letter from Capt. W. E. Hay, of the 1st European Light Infantry Regiment, noticing amongst other matters, that he had been the means of bringing before the public a number of new Coins, which Lieutenant Cunningham would notice in his forthcoming work on the successors of Alexander the Great. In some instances circumstances had demanded his permitting them to pass into other hands, which although a matter of regret, yet he still fortunately possessed a few that were supposed to be unique, and of great value.

Read letter from J. H. Batten Esq. of 10th July last, forwarding continuation of Major Manson's valuable Journal, with Lieutenant Weller's Notes, and promising by next opportunity, the Journal by Lieutenant Weller, of the country beyond Oonta Dhoora, at the same time proposing Brevet Captain Boys, 6th Cavalry, (with his consent,) as a member of the Society.

Captain Boys was accordingly proposed in due form as a Member of the Asiatic Society, and the Journal referred to by Mr. Batten made over to the Secretary for publication in his Journal.

Read letter from Reverend J. H. Pratt, of 11th August 1842, on the brass Astrolabe from Herat, presented to the Society by Major E. Pottinger, also made over to the Secretary for the Journal.

Read the following report from the Curator for the month of July, 1842.—

Sir,—The most interesting recent accessions to our collection of vertebrated animals pertain to an important class, that of Reptiles, which hitherto I have been too much otherwise occupied to investigate except casually.

From Dr. Strong, we have been favored with a fine specimen, but just dead, of *Chelonia midas;* the Edible or Green Turtle, which has been mounted. It may be as well to remark, that this was not captured in the neighbouring Bay.

Having intimated a wish, not long ago, to possess some of the so called "Iguanas" that inhabit the tanks of the Botanic Garden, the Society has accordingly been kindly favoured by Mr. DeCruz, of that establishment, with three fine specimens, which have proved to be of as many different species. These it may be useful to Indian students of Natural History to describe.

1. *Varanus Bengalensis*, Dumeril and Bibron, in whose excellent 'Histoire des Reptiles', III, 480, will be found its synonymes. Length of the specimen (a female) forty-one inches, of which the tail measures twenty-four inches: head, to auditory orifice, three inches; to anterior margin of eye an inch and three-quarters; and the nostrils oblique, and situate half-way between the eye and tip of muzzle: entire length of fore-limb to end of middle claw five inches and three-quarters, and of hind limb, to end of claw of longest toe, seven inches and a half; the toes well developed, and claws, especially the anterior, very large and strong.* The head is covered with minute polygonal plates, nearly uniform in size, and the superorbital bone projects far over the eye: the nape is studded with scales of a rounded oval form, very much bulged, and each appearing like a nail set at the extremity of a digit; on the back this unguicular appearance is more strongly marked, the nail-like part being smaller,

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* A very fine and bulky male, since procured in the same quarter, measured fifty-five inches in total length, of which the tail was thirty-one inches; from muzzle to auditory orifice three inches and a half; and length of hind-limb, to tip of the claw of longest toe, nine inches and a quarter: colouring exactly as in that above described.

and the scales flatter: on the fore-limbs anteriorly, the scales form hexagons, and are larger than elsewhere: the tail is clad with transverse series of oblong subquadrangular scales, those of its sides a little carinated, and the inferior scarcely exceeding them in size; along the ridge of the tail is a double serrated crest of laterally triangular scales, more strongly developed than in either of the following species: the under surface of the neck, breast, and inside of the limbs, are clad with rounded oval scales, and the belly with transverse series of others having an elongate subquadrangular form. The colour of this specimen is greenish olive-brown on the upper parts, very prettily and uniformly marbled with meandering lines of black scales, this black being nearly as broad as the intervals of ground-colour left between its courses: the head inclines to yellowish green, and has the black markings large and bolder; and the extremity of the tail is similar in hue, having the markings gradually fewer till they disappear: the under-parts are whitish, deeply tinged with yellowish-green on the neck, which is marbled as on the upper-parts, only that the lines are broken or not continuous; and the breast and belly are merely spotted with black, though the whitish scales are also minutely freckled with the same, the markings on the under surface of the tail being less defined. A constant character of this species is to have a black streak proceeding backward from the eye, which is broader and more developed than in the following species; and the toes have each a distinct yellow streak along their upper surface. Of various young *Varani* which we possess in spirits, there is only one which I incline to refer, with some hesitation, to the present species, the principal objection being that its claws do not appear to be proportionally large enough: the situation of the nostrils and proportion of the superorbital bones are, however, the same, and I can perceive no characteristic difference in the scaling; but the markings are more different, appearing on the upper parts of this one as irregular transverse series of pale yellowish-olive spots—each occupying three or four scales—on a dusky ground-tint, while beneath the colour is almost uniform yellowish, having transverse narrow dusky streaks on the throat and neck, and others extending downwards from the sides, but interrupted along the middle, where are only a few scattered specks; the under surface of the tail being altogether without markings."

2. *V. Picquotii*, Dumeril and Bibron. The specimen sent of this reptile, measures thirty-two inches in length, of which the tail is seventeen inches, being deficient of about an inch and a half of its extremity; from muzzle to orifice of ear is two inches and a half, and the nostrils are only half an inch distant from the former, being placed considerably more forward than in the preceding species; length of fore-limb to end of middle claw four inches and three-quarters, and of hind-limb to end of longest claw five inches and a quarter, the toes being comparatively very short, and the claws, especially the posterior, small for a *Varanus*. The head is covered with small polygonal plates, and the scales of the body are considerably larger than in either of the others, their form an elongate oval and much carinated, but becoming circular towards the occiput, where especially they are much larger than in the preceding species. The tail is more compressed towards its base than in *V. Bengalensis*, and also less attenuated or drawn out at the tip; the double serrature of its upper ridge is less strongly marked, and its scales are smaller and much narrower or more elongate, being also but little larger on its under surface than on the sides: those on the under part of the neck are nearly circular, becoming more oval towards and

upon the breast, while those of the belly are of the usual oblong-quadrangulate form. The general colour is yellowish olive-green above, irregularly banded with reddish-brown having dusky margins, which latter throw out lines across the greenish, so as to separate this into large round spots; these markings, however, are not very strikingly conspicuous: the tail is barred with successive pairs of transverse dusky bands, enclosing somewhat rufous brown interspaces; and the under-parts are pale and spotless, inclining much to yellowish-green on the belly, and having a few very faint dusky bars across the neck: above, the neck is uniform-brown, and the crown darker; there is a narrow streak of blackish behind each eye; the fore-limbs are sulphur-yellow, and the hinder coloured like the back and tail. Of several young which we possess in spirits, the largest measures nineteen inches, of which the tail is ten inches and a half; general colour similar to the last, but much paler, and legs green (the latter, however, may have faded), the dusky cross-bands underneath the neck are more distinct, the head and neck above are very pale, and the darker colour—though less deep than in the preceding– is more predominant on the back, so as to leave only a series of irregular whitish cross-bands. Another ten inches and three-quarters long, with the tail five inches and a half, is intermediate in its markings to the two preceding, but much darker than either; the cross-bars beneath its neck are very distinct, and there are others descending from the sides of the body, but interrupted along the middle of the under-parts, which lines are considerably less distinct in the last specimen, and but just visible in the large one. Still smaller examples, but six inches and three-quarters long, of which the tail measures three inches and a half, are more like the large one, but differ in having their markings well brought out and brightly contrasted: one has alternate broad and narrow cross-bands of pale greenish more or less divided into spots; and another has the same kind of bands less regular, both these having also the nape pale greenish, and banded with dusky-brown, which is broadest at the median line. It is clear that the particular markings of each individual specimen are permanent for life, as regards disposition, but become gradually indistinct, and more or less effaced, with age; the dark, which at first appear of uniform tint changing to brown where broad, leaving dusky edgings only; while different specimens vary at all ages considerably from each other, and are pale or dark, very probably according to the soil on which they inhabit.*

The *V. Picquotii* is remarkable for its comparatively short toes and small claws, and for the strong yellowish tinge which prevails more or less on its olive-green ground-tint. M. M. Dumeril and Bibron remark that they have every reason to believe that the *Monitor flavescens* figured by Hardwicke and Gray represents this species, although the scales are not shewn to be carinated, which, however, may have been an omission of the draughtsman; and accordingly they have included that denomination as a synonym, but without stating that the name *Picquotii* had been published prior to that of *flavescens*, which latter appears in the 'Zoological Journal,' III, 225. There certainly can be no doubt of the correctness of this identification.

3. *V. binotatus*, Dumeril and Bibron. The example sent of this species measures four feet and a quarter in length, of which the tail is thirty-one inches, thus exceed-

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* I have since obtained other adults of this species, but none so large as that of which the dimensions are above given. They vary considerably in their markings, and in some the rufous brown colour predominates over the usually prevailing olive-green. In all the tribe, the colours of the living animal are much brought out by putting it into water.

ing, by more than half, the aggregate of the head, neck, and body: the head measures nearly four inches to auditory orifice, and two inches from eye to muzzle, the anterior margin of the nostrils being within half an inch of the tip of the latter: length of fore-limb to end of middle claw seven inches, and of hinder to end of longest claw nine inches; the toes well developed, and furnished with large claws, though inferior in size to those of *V. Bengalensis.** The head of this species is much more elongated than in either of the others, and has a curvilinear series of eight broad transverse scales above each orbit, conspicuously developed, while in the others the corresponding plates must be sought for to be observed: the auditory orifice is broad and open. The scales of the upper parts resemble those of the last species in form, being oval and much carinated, but their size is much smaller, especially upon the nape and towards the occiput; on the sides of the tail they are small and oblong-quadrangulate, and on the under surface of the tail they are very much larger, a particular in which this species differs from both the preceding: they are of an oval shape upon the throat, breast, and inside of the limbs, inclining to circular on the latter; and upon the belly they nearly resemble those of the under surface of the tail. This fine specimen has black scales with whitish intervals on the upper parts, and is banded across the body with several distant rows of white rings; immediately behind the scapulars the first of these rows is less distinct, forming merely an obscure broad whitish band, anterior to which a broad longitudinal black streak proceeds backward from above each fore-limb, surmounted by a whitish one, not conspicuously developed in this specimen, but which is usually well marked, and from it is derived the specific name which the reptile bears; the anterior limbs have a white spot on each scale, in addition to which the hind-limbs have scattered wholly white scales, imparting a speckled appearance: the under-parts are dull white, with incipient dark stripes from the sides of the body, and the throat and under surface of the neck are speckled with black, having besides a series of V-like cross-streaks pointing forwards; tail minutely mottled black and whitish, with broad bars of the former, indistinct for the basal two-thirds, and the rest successively blacker to the end. Another specimen, of similar size, which we possess as a skin, differs only in having no markings underneath the neck, the black bands are less distinct on the tail, and the transverse rows of pale rings on the body less conspicuous: in this the lateral pale shoulder-streaks are but just visible, and varieties of this species have been met with altogether black. We do not possess examples of the young.

I kept the specimen of *V. binotatus* here described alive for some days, chained to a tree, which occasioned me to notice that it climbed the trunk with facility, and I also observed that its regular mode of defending itself was by slapping smartly with the tail, for which purpose it turned itself with the tail towards any one who annoyed it: but I make no doubt that, like other lizards, it would also bite if it had the opportunity, when the compressive force of its jaws would render its small teeth of some efficacy as a weapon.

A fourth Indian species of this genus already described, and which is common to Bengal, Siam, and the Malay countries, is the *V. nebulosus* of M. M. Dumeril and Bibron; being stated to be one of those wherein the muzzle is most pointed. Accordingly, this is at once a distinction which separates from it a small specimen in the Society's Museum, which appears to be of an undescribed species, and I shall therefore venture to designate it *V. Bibronii.* It is remarkable for the great length of its tail, but in other respects is nearly allied to *V. Bengalensis:* its naral apertures are situate as in that species, but the head is less flat, and a peculiar character consists in a group of central plates between the eyes, which are considerably less minute than the remainder of those upon the head. Length of the specimen twenty inches and a quarter, of which the tail measures thirteen inches, being very much drawn out at the end; at base it is perfectly cylindrical for about two inches, when the double serrated crest commences, which is not so strongly marked as in *V. Bengalensis,* the tail becoming thence more compressed to its extremity. General colour bright olive-brown, marked all over the body with longitudinal rows of alternately larger and smaller angular black spots; head tinged with yellow, and marked with a dark ring surrounding the group of larger scales between the eyes, behind which is a dark semi-circle pointing backwards, then another ring, flanked by a lateral black line along each side; the usual dark mark behind each eye, but narrow, and continued along the side of the neck; fore-limbs mottled with brown, olive, and yellow, having a streak of the last along each toe; the hind limbs and also the flanks shewing scattered pale yellow spots, which are surrounded by dusky-brown forming *ocelli*; tail indistinctly mottled, and yellowish for its terminal two-fifths, beneath, and the rest of the lower parts, also yellowish, irregularly marked with brown, the neck banded with dusky underneath, and between each of the bands a transverse row of spots. The specimen thus described is preserved in spirit; and I find that we have also a stuffed skin, which appears to be referrible to the same. This was received from Madras, and confiding in the judgment of an eminent Zoological acquaintance who has much studied the Indian *Reptilia,* I referred it to *V. binotatus* in my first Report to the Society. The length of this is twenty-three inches, of which the tail measures thirteen inches, but the neck is made rather longer than it ought to be. Colour above dusky brown-black, relieved with a few scattered inconspicuous whitish scales; beneath yellowish-white, mottled with spots and specks of dusky except under the tail, while the fore-neck is greyish and rather more densely mottled: the group of larger scales between the orbits is paler than the rest; and on the flanks and thighs are scattered ocelli as in the other specimen. I have little doubt that this is the species which I observed to be brought in considerable numbers to the bazar at Madras, being much eaten there by the natives; but I hope soon to receive some large specimens from that locality, which will determine the question. I certainly remember to have particularly noticed the great length of tail in the Madras species, by means of knotting which round the limbs the dealers disabled them from running away.

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* The larger of two specimens since obtained, measured sixty-one inches in total length, of which the tail occupied thirty-four inches; from muzzle to auditory orifice four inches and a half; and length of hind-limb, to the tip of claw of longest toe, ten inches and three-quarters.

A species of *Varanus,* additional to those described in the very excellent work of M. M. Dumeril and Bibron, was obtained in the island of Mindanado by Mr. Cuming, and is described as *V. Cumingi* by Mr. Martin in *Proc. Zool. Soc.* for 1838, p. 69; and in the same work for 1831, p. 137, is a notice of the anatomy of a *Varanus* by the same author, which had lived for some time in London at the gardens of the Zoological Society.

By Mr. Piddington, we have been favored with a male specimen, and by our Secretary with a female, of an Agama common in the neighbourhood, appertaining to the subdivision *Calotes*, being probably the *C. Tiedmani*, Kaup, *Isis*, XX, t. 8, as quoted in Gray's *Synopsis Reptilium* appended to the 9th Volume of Griffith's Animal Kingdom', where the following synonymes are attached,——*Agama versicolor*, Daudin, t. 44, *A. flavigularis*, Daudin, and *A. Indica*, Gray. This species averages fifteen inches in length, whereof the tail exceeds eleven inches and a half; the longitudinal series of vertical scales forming its nuchal crest are tolerably elevated, those along the back are much smaller, and at the base of the tail they are nearly obsolete; there is also another series above each ear, divided into two groups, each of which has a single pointed scale longer than the rest. Colour changeable, but usually vivid-green, more or less tinged with yellowish, especially on the sides; beneath, whitish, the throat of the male often bright red: the markings also vary, but when well brought out consist of a row of large quadrangular spots along the back, changing from yellowish-brown more or less black-edged to wholly black, and a similar row along each side, between which and the former the ground-tint forms in some a pale band. The very long tail of this beautiful little animal is commonly raised to curve over the back. "It is the liveliest by far," remarks Mr. Torrens, "of the Lizard tribe that I ever saw: its motion is a most rapid darting run for from six to twelve yards, standing high on the fore-legs, and carrying its head singularly erect; it then comes to a dead stop, and remains motionless with the head erect for sometimes a minute and a half, when the rapid motion is resumed to be succeeded by a similar halt: it is very active, leaping from the ground upon shrubs, and its demeanour is markedly vivacious. This specimen I have watched for some weeks: it frequented a flower-pot opposite my dressing room, and seemed to harbour under a particular shrub."

Our Museum contains also a single example of a species closely allied, but nearly as large again, with the nuchal and dorsal crests more developed; this I presume to be *C. ophiomachus*, Kaup, v. *Lacerta calotes* of Seba and Linnæus, whereof the colour should be brilliant blue, but the fine tints of these animals wholly fade in specimens consigned to spirits.

From J. Baker Esq., Civil Surgeon of Noacolly (Bullooah), near Calcutta, has been received a species of *Trigonocephalus*, stated by him to be of rare occurrence, at least in this district. It appears to be nearly allied to *Tr. erythrurus*, Cantor, *P. Z. S.*, 1839, p. 31, (which also is indigenous to the Gangetic delta,) having the same number of abdominal plates and subcaudal *scutellæ;* but the tail has merely a very faint reddish tinge, and there is no black serrated line enclosing the abdominal plates. Length thirty-two inches, of which the tail, posterior to the vent, measures four inches and three quarters. Colour wholly dark grass-green above, beneath greenish white, the tint deepening towards the vent and along the under surface of the tail; sides of upper lip, and below ears, bluish; and wholly without markings, through the lateral row of scales bordering the abdominal plates are lighter-green than those above them, and may form a line more or less defined in younger specimens.

The only additional examples of this genus we possess consist of two small and probably young specimens, nearly allied to each other and to the above, and possessing the same number of abdominal plates. One, measuring twenty-three inches and a half, of which the tail is four inches and a half, and consequently longer in proportion than that of the preceding species, is wholly of a leaden-blue colour above, with whitish under-parts; no lateral line; a remarkable (though probably merely individual) distinction consisting in four or five of the plates immediately anterior to the vent tending to assume the divided form of those of the tail, being in fact more or less divided and oblique. The other specimen is twenty inches and a half long, with tail four inches and a quarter; and is also leaden-blue above, and whitish gradually more suffused with blue for the first third of its under surface, the rest uniformly bluish and deepening to under the tail: it has also a narrow yellowish-white lateral line commencing under the eye and continued for its whole length. This is allied to the ***Bodroo Pam*** of Russell's 'Indian Serpents', plate IX., as indeed are the others also, and likewise to the *Tr. purpureo-maculatus* figured by Hardwicke and Gray.

From Dr. Thomson, who has already favored us with a highly interesting box of insects from Afghanistan, I have now to record the donations of a mounted human skeleton (that of an Englishman), excellently prepared and set up, and of an extensive collection of insects, filling 21 glass-fronted cases exceeding a foot square, and of which the contents of 18, consisting of the orders generally, were obtained in the vicinity of Agra, while the remaining 3 are filled with Himalayan *Lepidoptera*. This fine collection has arrived in most satisfactory condition, and constitutes, of course, a very important accession to our entomological cabinet, (the previous extent of which is briefly noticed at p. 604,) albeit a greater community of species occurs than would perhaps be anticipated in the entomology of the neighbourhoods of Agra and Calcutta.

Our esteemed contributor, Robt. Ince, Esq., has favored us with some specimens of a small Weevil known as the Mango Beetle, which prevails, as he informs us, "in the districts of Sylhet, Furreedpore, Dacca, Tipperah, Backergunge, and *half* Jessore—but strange to say, our own mangoes which, in 1835, I brought as grafts from Santipore, and planted in a pucka terrace with a wall round, are quite free from them; however, there is no accounting for them, for on enquiry it appears that frequently with two trees planted close to each other, the one has the insect and the other not." I have not the means of determining the genus of these insects which are found in all stages within the fruit of the Mango.

A fine Hawkmoth, of the genus *Sphinx*, has been presented to the Society by Mr. Borradaile. The only bird with which we have been favored since the last Meeting is a skin of *Cryptonyx coronatus*, from Captain Macleod.

In this class, I have also little to report on as concerns our own collecting. For a long while, in consequence of the heavy rains, not any were brought to the bazars, and the only rare species to the neighbourhood, which has been procured, is a fine male of *Oxylophus Coromandus.* Due progress has, however, been made in mounting our great accumulation of skins, and I have procured fine series of two species of *Euplectes* in addition to the common Weaver-bird, or *Eu. Phillipensis.* These do not appear to have been hitherto distinguished, and the females and young of both may be alluded to as *Eu. aurinotis* by Mr. Swainson, *Class. Birds,* II, 279.

Eu. Phillipensis, the common Baya or Weaver-bird of India generally, as also of the Malay countries, does not appear to attain its full colours until the third or fourth year. The young are like the females, and the once moulted males vary much in the intensity of the yellow colour upon the head, which in some attains its full brightness, while others exhibit little more than a yellowish tinge; and there is also seldom any trace of yellow upon the breast at this age, beyond perhaps a feather or two, the rest being light rufous-fulvous, while the isolated yellow feathers alluded to are not new and indicative of a moult going on. In this state of plumage, great numbers may be now (June and July) purchased of the dealers, while no yellow-breasted specimen will be found among them; the latter, however, may be procured at the breeding assemblages, though only in a small proportion to the number of birds; and these again differ much in the quantity of yellow exhibited on their under-parts, it being perhaps not until the fourth or fifth year, varying in different individuals, that the full amount of this colour is thrown out. This species has its yellow paler and much less inclining to orange than in the others, which latter, too, are devoid of any upon the breast, and the female has no yellow lateral neckspot nor other trace of this colour, as occurs in both the other species.

Eu. Bengalensis; Loxia Bengalensis, Lin.: *Coccothraustes chrysocephala*, Vieillot: *Eu. albirostris (?)*, Swainson. Length five inches and three-quarters, by nine inches and a quarter across; wing from bend two inches and three-quarters, and tail an inch and three-quarters. In all states of plumage this may be readily distinguished from the next species by the following characters;—the rump (and head and neck of the female and young) are not uniformly striated with the back and scapularies, but streakless, and the breast also is not marked with numerous longitudinal black streaks, but is uniform pale fulvous, with a broad black pectoral cross-band more or less developed; bill also more neatly formed, of a glaucous colour, *i. e.* bluish or pearly white in the adult male, whereas in the other it is deep black (as in *Eu. Phillipensis*). The mature male has the crown brilliant golden-yellow, with a slight inclination to flame-colour; back nearly streakless, and in one specimen dusky-blackish, while the rump is plain dingy grey-brown; a very broad black band crosses the breast, and the throat is white, and ear-coverts and sides of the neck suffused with dusky. Another specimen is generally paler, and has the throat, ear-coverts, and sides of the neck, pure white, with a tinge of yellow beneath each eye; the pectoral band is likewise interrupted in the middle, and considerably less broad than in the preceding. An old female has the pectoral band entire, but somewhat narrow; the crown streakless dusky-brown, slightly tinged with yellow; a bright yellow spot on each side of the neck, beyond the ear-coverts; superorbital streak of the same, paling towards the occiput, and throat deeply tinged with yellow, which forms a sort of moustache-streak on each side. Irides of all dark, and legs dusky flesh-colour. These are the only adults I have seen, among multitudes of the young in (presumed) second plumage. The latter were first brought to the bazar early in May, when great numbers were to be seen, all very similar, and such as I have kept alive from that time have as yet undergone no alteration: their feathers were worn, occasioning the black pectoral streak to appear conspicuously in all; whereas in another large quantity of these birds recently brought, and from among which I selected the adults, this pectoral streak was more or less concealed by terminal edgings to the feathers, of the same pale fulvescent hue as the rest of the under parts: in other respects all resembled the adult female, but the newly moulted birds have generally the eye-streak, neck-spot, and throat of a brighter yellow, than when this plumage becomes worn: bill flesh-coloured. Dr. McClelland, to whom I shewed both this and the next species, is disposed to doubt whether either of them occurs in Bengal;

and whence the dealers are supplied with them I cannot satisfactorily assert, as they pass from hand to hand among them, and the statements of such people, concerning what they do not in the least interest themselves about, are not trustworthy. It is even a common practice with them to pass whatever they can off as Chinese, thereby, it would seem, thinking to enhance its marketable value.* However, there are specimens of the next species among those collected by the late Sir A. Burnes in the Western country; and Mr. Jerdon notices the present one, remarking, however, that he had not himself met with it, "but finds it recorded in Mr. Elliot's notes, as found occasionally in the Southern Mahratta country. That gentleman says that, 'the male has the yellow crown only in the breeding season. At other times only eye-brow and ear-spot are yellow. Their nests, though similar, are smaller than those of the common Baya, and have two chambers. Habits the same as those of the Baya.'" It will be seen that I differ in opinion from Mr. Elliot regarding the phases of plumage of these birds, which seem to depend on age and not on season.

Eu. striatus, nobis, n. s? Size of the last, or a trifle larger, having a black mesial stripe on each feather of the breast and flanks; the rump (and head and neck of the female) uniformly striated with the back and scapularies; neck, throat, and cheeks, of the male, dusky-black; and bill deep black, that of the female yellowish horn-colour. Crown of the male brilliant golden-yellow, and black generally predominates on the upper-parts, which are much more streaky than in the adults of the preceding species. The female is very similar to the young of *Eu. Bengalensis* in newly acquired second plumage, having the same yellow superorbital streak and neck-spot, more or less bright; and the under-parts are usually tinged with yellow, but are readily distinguished (like the crown and rump) by their streakiness. These birds have lately been sold in great numbers by the dealers, mingled with the preceding species, and it is remarkable that all of this kind have been in fully adult plumage, the males at least having the crown very brilliant yellow, as indeed have some of the young males of *Eu. Phillipensis*. It may be, therefore, that the mature plumage of this one is assumed at the first moult.†

I have the honor to be,
Sir,
Yours obediently,
ED. BLYTH.

Report of the Curator Museum Economic Geology, for the month of July 1842.

Museum Economic Geology.—We have to announce here the arrival of three boxes of specimens from England, procured for us by Captain Tremenheere. The letter accompanying them, of which copy is transmitted by Government, is as follows:—

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* Great numbers of small birds are continually brought to Calcutta from Singapore, which taken hence to Europe, are there regarded as natives of this country; whereas, in truth, many of them do not inhabit this region.

† I have recently been assured that this species breeds abundantly in the reeds, margining some large tanks, a few miles to the southward of Calcutta; and that *Eu. Phillipensis* occasionally resorts to the same situations, in lieu of suspending its beautiful nests to the fronds of the fan-leaved palms, as is its usual habit. It is remarkable that the beak of *Eu. striatus* becomes gradually white after breeding, commencing at the base, but never bluish-glaucous like that of *Eu. Bengalensis*.

No. 141.

To J. H. Young, Esq.

Deputy Secretary to the Government of Bengal.

Sir,—I have to acknowledge your letter No. 123 of the 12th ultimo, advising the receipt of three boxes addressed to me, to the care of Mr Phillips, Museum of Economic Geology, No. 6, Craig's Court, Charing Cross, London.

2nd. In reply, I beg to inform you, that these boxes contain specimens of metallic ores, or others, illustrative of metallurgical processes, which are intended for the Museum of Economic Geology, established in January 1841, in one of the rooms of the Asiatic Society at Calcutta.

3rd. The Specimens in question, form part of a Collection designed to aid in the development of the mineral resources of India, the first portion of which was brought out by me at the period above-mentioned, under sanction of the Honourable Court of Directors. For its progressive increase, I arranged, before leaving England, with Sir H. T. De la Beche, F.R.S., &c. &c. Director of the Museum of Economic Geology in the Department of Her Majesty's Woods and Forests, for the occasional transmission and interchange of specimens of mineral products. I was likewise promised by gentlemen, connected with mines and manufactures in Cornwall, Northumberland, and Wales, several series of specimens suited to the objects in view.

4th. It was arranged that these boxes of specimens, when ready, should be forwarded to the care of the Curator, Mr. Phillips, of the London Museum of Economic Geology, from whence they were to be forwarded to Calcutta by the proper authorities at the India House, who had instructions from the Court of Directors to that effect.

5th. Any boxes therefore that may in future arrive, addressed in a similar manner to those which are the subject of this letter, may, unless marked "Private," be transferred at once to the Government Museum of Economic Geology at the rooms of the Asiatic Society.

I have the honor to be &c.

(Signed,) G. B. Tremenheere, *Captain,*

Executive Engr. Tenasserim Provs.

Revenue Department, the 20th June, 1842.

(A true Copy.) Fred. Jas. Halliday,

Moulmain, 19*th April,* 1842. *Secretary to the Govt. of Bengal.*

The contents of the boxes are as follows:—

One box ores of copper, &c. copper and tin with other minerals as fluor spar, &c. indicating the modes of occurrence of the ore in the veins.

One box larger specimens, mostly duplicates of the foregoing.

One box coal, from the Newcastle coal-field.

We have also received from Major Ouseley, Agent to the Governor General, N. W. frontier, specimens of gold and gold dust from the Brahminy river;

Specimens of Garnets from the Bora Sambur, a tributary from the South to the Mahanuddee;

And of an ore of lead and antimony, with the matrix in which it occurs from near Hazareebaugh.

The last mineral is under examination, and will be duly reported on.

From J. H. Batten, Esq. C. S. an assortment of ores of iron, copper, lead, &c. from Kemaon, have just arrived while I am writing. These will also be noticed in more detail in the next report.

Geology and Mineralogy.—I have the pleasure of congratulating the Society upon the recovery of Captain Herbert's Geological Map, as will appear from the following letter, in reply to that addressed by our Secretary to Government.

No. 582.

To H. Torrens, Esq.

Secretary to the Asiatic Society.

General Department.

Sir,—In reply to your letter dated the 1st instant, I am directed to acquaint you, for the information of the Committee of Papers of the Asiatic Society, that Captain Herbert's Geological Map, and the twelve colored Views of mountain scenery, referred to by the Committee, were forwarded to the India House, under date the 1st February 1827, and that an application will be made to the Hon'ble the Court of Directors for copies of the Map and Views, for preservation in the Asiatic Society's Rooms with the MS. Report recently recovered. I am, Sir,

Your obedient servant,
G. A. Bushby,
Secretary to the Government of Indi

Council Chamber, the 20th July, 1842.

We have thus succeeded, I trust, in a public service of no small importance to the cause of science, which I doubt not will be fully appreciated by Geologists in Europe, to whom the remarkable phœnomena presented by the formations of India, are of the very highest interest.

I am happy also in being able to announce, that there is every probability of the recovery of the Catalogue of Capt. Pemberton's valuable Bootan specimens, alluded to in a former report; for in a reply received from Capt. Blake, now at Sepree, who commanded the Escort, he describes so distinctly the book in which the notes were kept, that there is little doubt it will be found amongst his papers. General Macleod has again been written to on the subject, and I need not add, that we are certain of his most zealous assistance in all things. Capt. Blake's reply is as follows :—

Seepree, 7th July, 1842.

My dear Sir,—I have had the pleasure to receive your letter of the 21st ultimo, regarding the Geological specimens handed to you by Col. McLeod. I extremely regret, that I have no clue whatever by which you would be able to assign localities to the different specimens. Pemberton used to put down in a note book (with a parchment cover which you may perhaps yet find) whenever he picked up, or broke off a specimen, its locality, numbered it, the dip of strata if we happened to be amongst stratified rocks, and whatever other information he thought useful. The loss of the book vexes me much, for my esteemed friend took an infinity of trouble to make every information regarding the unknown land of Bhootan as full as possible. I was hurried away from Calcutta at so short a notice, that I had not time to fill in a Section of Bhootan, (which I had prepared on a large scale,) so as to shew the Geology throughout every mile. This outline I left with Pemberton, who gives it on a smaller scale in his printed repo[illegible]ut he *may* have filled up the one he got from me; if you have the luck to get it, much trouble will be saved you. In Pemberton's Report there is a Synoptical Table, showing, amongst other things, the Geology of every stage, which will enable you to lay out the specimens not far from the truth, but it is not of course altogether satisfactory. Regretting extremely my inability to give you the required information, I remain,

Very faithfully your's,
M. T. BLAKE.

I have been also engaged in examining five volumes of Dr. Voysey's Journals. My report on them is partly stated in my letter of the 19th instant, addressed to our Secretary, and with the approbation of the Honorable the President, Government has been addressed as therein recommended; and when I add that Dr. Voysey's whole time may be said to have been spent in crossing and recrossing the vast field of the trap formation from the Kistna to the Ganges, and from Cuttack to Bombay, noting day by day his acute and able remarks on it, it will be conceived with what interest these will be read in Europe, and how much they may contribute to advance our knowledge of the Geology of India. Our Secretary has authorised me to employ a Copyist for the purpose of extracting the geological and mineralogical details, (which require to be separated from various others with which they are mix-up) for the purpose of publication in the Journal, and I hope also to recover from our neglected stores, some of the series of specimens to which the Journal refers.

30*th July*, 1842. H. PIDDINGTON,
Curator Museum Economic Geology.

For the contributions and presentations, the thanks of the Society were accorded.

Proceedings of the Asiatic Society.

(Friday Evening, 2d September, 1842.)

The Hon'ble H. T. PRINSEP, Esq. President, in the chair.

Messrs. JAMES MACKENZIE and A. S. GLADSTONE, proposed at the last Meeting, were ballotted for, and unanimously elected Members of the Society.

Ordered—That the usual communication of their election be made to Messrs. MACKENZIE and GLADSTONE, and that they be furnished with the rules of the Society for their guidance.

The Secretary submits in Persian and Oordoo MS. the work entitled "Tareekh-i-Nadree," proposed to be printed. The Secretary stated, that he had taken every care to procure the best MS. for collation, He had sent for the purpose to Lucknow, and had received thence, an[illegible]m other parts of the country, nine MS. some of them having the character of great correctness. These MS. would be collated by Molvee Gholam Ukbar, Persian Librarian to the Society, with the aid of some native friends of the Secretary, who after careful perusal of the MS. produced by the collation, would submit it for approval to the Hon'ble the President. Ordered accordingly.

Ordered—That the Librarian of the Society be directed, with the aid of Readers, to prepare a List of the Readings of the Books, vol. 1 to 8.

Library.

The following Books were presented :—

Books received for the Library of the Asiatic Society, for the Meeting on the 2d Sept. 1842.

The Edinburgh New Philosophical Journal, by Professor Jameson, No. 64. Edinburgh, 1842, from the Editor.

Minutes of the Committee of Council on Education. London, 1841, from Govt.

Reports on the training of Pauper Children. London, 1841, from Govt.

Naturalist's Library.—Ornithology, Vol. XII. British Birds. (Purchased)

——————.—Entomology, Vol. VII. Foreign Moths. (Ditto.)

Lyell's Principles of Geology, sixth edition. London, 1840, 3 vols. (Ditto.)

Merrat-ul-Janaun, Maroof Tarikh-ia-pha-i, 1 vol.

The Calcutta Literary Gleaner, Vol. I, No. VII. Sept. 1842, from the Editor.

Oriental Christian Spectator, June 1842, second series. Vol. 3d, No. 6, from the Editor.

Journal of the Bombay Branch of the Royal Asiatic Society, January 1842, No. 3, from the Society.

The Report of the British Association for the advancement of Science, for 1841. London, 1842, one vol. from the Association.

The Trials of P. and M. Wallace. London, 1841, one vol. from A. Rogers, Esq.

Yarrell's History of British Birds. London, 1842, Vol. III. pt. 29, purchased.

London, Edinburgh and Dublin Philosophical Magazine and Journal of Science. Vol. XX, Nos. 129 and 131, purchased.

The Annals and Magazine of Natural History, Vol. IX, No. 57, purchased.

Royle on the Production of Isinglass along the Coast of India London, 1842. Two Copies, from the Author, P.

Hesychii Glossographi discipulus. Edidit B. Kapitar. Vindobonæ, 1840.

Wilson's Translations of the Vishnu Purana. London, 1840, 1 vol. from the Author.

A Bengalee Pottee MS. from ——

Read following letter from Professor Wilson of 2d July, 1842.

To H. Torrens, Esq.
Secretary, Asiatic Society of Bengal.

Dear Sir East India House, 2d July, 1842.

The Society will probably have been apprised by Messrs. Allan and Co. that the bust of Dr. Mill has been sent by them to Calcutta by my desire. I hope it will arrive in safety; it is one of the most successful of the late Sir T. Chantrey's works. The change from a picture to a bust, agreeably to the Society's instructions, involved an expence exceeding that for which provision had been originally made. £180 had been remitted by Mr. J. Prinsep to Messrs. Morris and Provost to await Dr. Mill's order, but Sir T. Chantrey's charge, as the Society is aware, was 200 guineas. I have paid the balance £30 to his executors, from the £200 in my hands on account of Mr. Prinsep's bust, as the whole sum will not I expect be required for the latter.

Little progress had been made in Mr. Prinsep's bust at the time of Sir T. Chantrey's death, and the executors were willing to transfer the model for completion to Mr. Weekes. I delayed, however, giving authority to Mr. Weekes to proceed until the model should have been seen by Sir E. Ryan and Mr. Wm. Prinsep, as they were expected in England. They have now seen the model, and suggested various alterations; and in fact, Mr. Weekes has made an entirely new model, under Mr. Prinsep's guidance. He and Sir Edward Ryan have both expressed their approbation of the model, and their favourable opinion of Mr. Weekes's talents, and I shall therefore direct him to complete the bust without delay. His terms are lower than Sir T. Chantrey's, and I hope therefore to be able to discharge them from the money of the Society in my hands, notwithstanding the deductions on account of the bust of Dr. Mill. There may be perhaps a surplus, and in that case it may be advisable to provide a set of Pedestals of Scagliol , or imitation marble, for the Society's busts; but for this I shall require further authority, as well as information of the height and diameter of the Pedestals, should the Society think it desirable to have them sent out.

I am, Dear Sir,
Yours truly,
H. H. Wilson.

The proposal of the Professor to provide a set of Pedestals of Scagliola, or imitation marble, for the Society's Busts, with the surplus fund in his hand was declined, pedestals having been already provided.

Read following letter from Captain R. Wroughton of 27th August, 1842:—

To the Secretary of the Asiatic Society, &c. &c. &c. Calcutta.

Chunar, 27th August, 1842.

Dear Sir,

I beg to inform you, that I have placed under the care of Mr. Digney, proceeding to Calcutta, the three following specimens of Natural History, which, perhaps you will do me the favor to present to the Museum of the Asiatic Society, in my name.

1st. The skin of a female Gour or Bison of the rocky forests, bounding the basaltic table land of the Nagpoor State, and killed by my peopl[illegible]r Umurkuntuk, the source of the Nerbudda river, in the month of April last.

2nd. The skin of a common Crocodile, killed near the Soane river, south of Mirzapoor.

3rd. The nest of a species of Vespa Crabro. This insect is indigenous to the forests of the basaltic table land confining the Nerbudda river at its source. I never saw the insect myself, because I only reached that part of the country in March last, at which time it appears, they usually leave their nests, and return to them at the commencement of the rains. I am in hopes I shall be able to secure and send to the Museum some of the Hornets preserved in spirits, and for which I have written.

By this time I had hoped that I should have been able to forward some other specimens of Natural History, peculiar to the interesting country about Umurkuntuk, but unfortunately the Rev. Mr. Loesch of the Berlin Mission, who located himself with five German artizans, near Umurkuntuk in March last, with the express object of winning over the wild "Goands," to settled habits, the useful arts, and the advantages of civilized life, and though last not least to the inestimable blessings of mental culture and pure religion; has, I grieve to say, with the whole of his companions been carried off by Cholera, which has for some months past be[illegible] depopulating that country! Mr. Loesch and his friends promised me much a[illegible]sistance, which we are now deprived of.

It so happens, that the skins have been not only injured in the preparation, but otherwise by friction. I regret this, but accidents of the kind are unavoidable when quadrupeds or other large animals are skinned by ignorant people. In addition to this, the difficulty of conveying weighty specimens great distances over rugged and almost untraversed tracts, renders it impossible to pack them in such a way, as to preclude their injury during the transit from one place to another. I beg to subscribe myself,

Dear Sir,

Yours very faithfully,

Robt. Wroughton,

Captain, 69th Regiment N. I.

Ordered—That Captain Wroughton be specially thanked for his contribution and exertions to furnish information.

Communicated by H. V. Bayley, Esq. a letter from Baboo Eshan Chunder Banerjea of the Hoogly College, forwarding a MS., being, as he presumed, a correct Genealogical History, in Sanscrit and Hindwi verses, of the Nagbongshus of Chota Nagpore, presented to the Baboo while at Kishenpore, by Lál Debnath Shahdeo, of Sehag.

The Secretary reported, that on the examination of the MS. by Dr. Roer and the Pundit of the Society, they were found to contain genealogical tables of the Nagbongohur, composed in the Hindee language, but written in Bengalee character.

Read the following report from the Curator, Mr. Blyth :—

Sir,—Although the Ornithological department of our Museum may now be considered rich in examples of the species inhabiting Bengal and the Himalaya, it has hitherto been extremely deficient in specimens of those proper to Southern India; wherefore it is with much satisfaction that I now report on a fine collection of specimens from peninsular India, which has recently been presented to us by Mr. Jerdon, and which may be regarded as the first instalment of desiderata, from that quarter, which Mr. Jerdon is kindly endeavouring to procure for us,[*] whereof the value, too, is enhanced as verifying the actual species described or indicated by that naturalist in his "Catalogue of the Birds of the Peninsula of India," published in successive numbers of the 'Madras Journal of Literature and Science,' from XXIV to XXIX inclusive.

Of Mammalia, are sent

* *Herpestes*[†] ——— ? A Mungoose from the Neilghierries, allied to (but certainly distinct from) Mr. Hodgson's *H. auropunctata*, *J. A. S.* V, 235, identified by Mr. Ogilby as *H. Edwardsii:* this will shortly be described by Walter Elliot, Esq., the author of the excellent "Catalogue of Mammalia in the Southern Mahratta Country," published in the 'Madras Journal,' Nos. XXIV and XXV. It is also distinct from the allied Malayan *H. Javanica*, of which Mr. Elliot possesses a specimen, and as I can aver from recollection of the living *Javanica.*

* *Sciurus Delesserti;* lately figured and described, as Mr. Jerdon informs me, in the 'Magasin de Zoologie.' This animal is allied to the *Sc. insignis*, Horsfield, figured in the 'Zoological Researches in Java' of that naturalist, and also to another small species, from Bootan, in the Society's collection, which I presume to be undescribed, and shall therefore venture to designate *Sc. Pembertonii.*[‡]

* *Kemas hylocrius*, Ogilby, *P. Z. S.* 1837, p. 81; a head with the skin on. I have been assured by Mr. Elliot that this, and no other, is the so-called Ibex of the Neilghierries, noticed by me in a letter published in the 'Proceedings of the Zoological Society' for 1841, p. 63: and as, according to that naturalist, its habits are quite those of a wild Goat, keeping to the steepest and most inaccessible situations, the term *hylocrius* imposed by Mr. Ogilby, under the impression that this animal was the *Jungle Sheep* of Anglo-Indian sportsmen, becomes objectionable as applied to it. I have now been long satisfied that the so-termed *Jungle Sheep* of sportsmen refers to the Muntjac, Kakur, or Barking Deer, and a very intelligible description of the latter, as the *Jungle Sheep*, is given in a notice of certain of the Mammalia of the Tenasserim provinces, in the 'Bengal Sporting Magazine' for 1841, p. 445, which thus corroborates the information which I have received from other quarters. It is remarkable, however, that a rude figure of what certainly appears to be the *K. hylocrius* is contained among the drawings of Gen. Hardwicke bequeathed to the

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[*] A second large collection of bird-skins has since been received from the same gentleman.

[†] The species with an asterisk prefixed are new to the Society's Museum.

[‡] Vide p. 887.

British Museum, labelled *Warry-atoo* from the Chittagong hills: and I may add, that a Neilghierry specimen of this animal which Mr. Elliot shewed me, at Madras, was so much finer than that mounted in the Museum of the Zoological Society, with horns so much larger and longer, that if I had not a very perfect recollection of the latter, in addition to possessing drawings of it, I might perhaps have hesitated in identifying them as the same; the head now sent, however, has the horns about equally developed with those on the Zoological Society's specimen.

The Birds presented consist of

**Aquila imperialis*, Temminck, vel *Heliaca*, Savigny; *A. chrysaëtos* of Mr. Jordon's Catalogue.

**Aq. Vindhiana*, Franklin, *P. Z. S.* 1831, p. 114: young.

**Aq. pennata; Falco pennatus*, Auct.; *Spizætus milvoides*, Jerdon: young male.

Spizætus grandis; Nisaëtus grandis, Hodgson, *J. A. S.* V, 230; *N. niveus*, Jerdon's Catalogue.

**Heteropus perniger*, Hodgson; *Aquila pernigra*, Ibid., *J. A. S.* V, 227; *Nisaëtus ? ? ovivorus*, Jerdon, Supplement to Catalogue, and indicated only in the latter as a Black Eagle frequently seen on the summit of the Neilghierries: male and female, the latter particularly fine.

**Pernis cristata:* a young male, white beneath,—a female in more advanced plumage,—and a male still more advanced.

P. Ellioti, Jameson: a female, nearly white below,—and a male in more advanced plumage.—*N.B.* I feel far from satisfied of the distinctness of these two alleged species.

**Limnætus punctatus*, Jerdon; olim *Spizætus punctatus*, Supplement to Catalogue.

**Buteo longipes*, Jerdon.

**B. rufiventer*, Jerdon, Supplement.

B. teesa, Gray and Hardwicke; *Circus teesa*, Franklin; *Astur Hyder*, Sykes: an adult female and young male.

**Circætus albidus; Falco albidus*, Cuvier, Temminck; *Buteo melanotis*, Jerdon, Supplement.

Circus Swainsonii, A. Smith; *C. pallidus*, Sykes: male.

Falco Juggur, Gray and Hardwicke; *F. Luggur*, Jerdon: young female.

Falco subbuteo, female; the European Hobby Falcon. In *J. A. S.* ante, p. 162, I attempted to cast a doubt as to whether the true Hobby inhabited this country, suspecting that the specimens referred to it had either been females or young of the nearly allied *F. Aldrovandi*, vel *severus*, Horsfield; but although there can be no doubt that the Darjeeling male *F. Aldrovandi* which I there described was correctly referred to that species, a more decidedly characterized specimen of the adult *subbuteo* which I killed on the wing very late one evening in the immediate vicinity of Calcutta, leads me, after much consideration, to identify not only Mr. Jerdon's specimen as specifically the same, but also the two which I described as the female and young female of *Aldrovandi* on the occasion cited. The two species must certainly be very intimately allied, and I regret that we do not possess a specimen of *Aldrovandi* that might now serve for further comparison, and also that I do not know, and cannot find a description of the immature plumage of this species, which probably approximates very closely indeed to the corresponding garb of *F. subbuteo*.

*_F. vespertinus_, Lin.; _F. rufipes_, Tem.; _F. subbuteo_, Var. A., Latham, _Gen. Hist._ 1, 121, being the only notice of an Indian specimen which I have met with previous to the present instance, which latter relates to that described in _J. A. S._ XI, note to p. 162, as a small red-billed Falcon procured upon the Neilghierries in January.

*_Accipiter minutus ?_, Auct; _A. Besra_, Elliot and Jerdon: young male.

*_Astur Indicus_, Hodgson, 'Bengal Sporting Magazine,' 1836, p. 177; _A. palumbarius_, Jerdon, Catalogue, vide Supplement to the latter. A typical Goshawk, having an occipital crest: young male, and very fine old female.

*_Strix longimembris_, Jerdon.

*_Syrnium Sinense._

Meseidus Newarensis, Hodgson, _As. Res._ XIX, 168; _Bulaca monticola_, Jerdon, Supplement: male.

*_Scops castanopterus ?_ Horsfield.[*]

Ketupa Leschenaultii.

Tephrodornis sylvicola, Jerdon.

*_Dicrurus macrocercus_, Vieillot; _D. annectans_, Hodgson.[†]

D. æneus, v. _muscicapoides_, Hodgson.

D. retifer, Temminck, —_Malabaricus_, Gould, — _cristatellus_, Nobis, _ante._ Vide p. 799, _ante._

*_Hypsipetes Neilgheriensis_, Jerdon.

Tricophorus virescens, Jerdon. So far as can be judged from the specimen, this does not appear to differ from _Tr. flaveolus_, Gould, _P. Z. S._ 1836, p. 6.[‡]

*_Tr. Indicus._

*_Goldana_ (G. R. Gray) _atriceps ; Brachypteryx atriceps_, Jerdon.

*_Myophonus Horsfieldi._

Petrocincla Manillensis, vel _Pandoo_ et _Maal_, Sykes: male and female.

*_Turdus simillimus_, Jerdon; the Neilghierry Blackbird: male, female, and young.

*_T._ (_Oreocincla_, Gould,) _varius_ (_verus_), Horsfield; from the Neilghierries, _vide_ Jerdon's Supplement.

*_T. Wardii_, Jerdon. A remarkably coloured species, from Mysore, connecting the Blackbird group with the _Oreocinclæ_ of Gould.[§] Length about eight inches, of wing four inches and three-quarters, and tail three inches and three-eighths; bill to forehead (through the feathers) an inch and one-eighth, and to gape an inch and three-eighths; tarse an inch: third primary longest, and a little exceeding the fourth, second and fifth equal, and first rudimentary. General colour deep black, with a conspicuous pure white eye-streak; all the wing-feathers broadly tipped with white, except the four first developed primaries, which have more or less of their outer webs white-edged; under-parts from the breast white, tinged with carneous, the plumage of the flanks, however, only tipped with white: under surface of the wing marked with white, as in the _Oreocinclæ_: the upper tail-coverts are somewhat broadly tipped with white, and a tolerably large patch of the same is formed by the ends of the smaller wing-feathers: tail having its middle feathers but slightly tipped with white, the next largely, and the rest shewing successively more white on their inner webs, till on the outermost the feather is more than half white, being also, together with the penultimate, marked on the outer web with white towards the base. Bill dusky above and at the tip of the lower mandible, the rest yellowish: legs yellow. A female specimen.

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[*] A small species, procured in the vicinity of Madras. Mr. Jerdon, in a letter which I have recently received from him, doubts the propriety of my referring it, hesitatingly, to _Strix castanoptera_, Horsfield, remarking that Lesson has described the latter, from a Paris specimen, as a _Noctua_, and the description does not tally. It is probably a new species, and will be described as such by its discoverer.

[†] I have since obtained both this and the next species in the vicinity of Calcutta, where the latter is tolerably common in the cool season, and the former not rare. To the synonymes of _D. æneus_ (p. 800 _ante_), add _D. æratus_, Stephens (p. 801 _ante_).

[‡] Mr. Jerdon, however, to whom I have since forwarded a skin of _Tr. flaveolus_, considers them distinct, and I expect to receive other specimens from him of _Tr. virescens_.

[§] The _T. mollissimus_, Nobis, _J. A. S._ XI, 188, links the _Oreocinclæ_ with the _T. musicus_ group.

*_Garrulax cachinnans_; _Crateropus cachinnans_, Jerdon.

Dasyornis striatus; _Megalurus striatus_, Jerdon, Supplement; _D. locustelloides_, Nobis, _J. A. S._ XI, 602.

Pellornium ruficeps, Swainson, _Fauna Americana-borealis_, II, 487; _Cinclidia punctata_, Gould, _P. Z. S._ 1837, p. 137; _P. olivaceum_, Jerdon.

*_Malacocercus Malcolmi_; _Timalia Malcolmi_, Sykes.

*_M. griseus_; _Turdus griseus_, Latham.

*_M. Somervillei_; _Timalia Somervillei_, Sykes.

*_M. subrufa_; _Timalia subrufa_, Jerdon.

*_Timalia hyperythra_, Franklin.

*_Trichastoma_, (Nobis, _J. A. S._ XI, 795-6,) _poiocephala_; _Timalia poiocephala_, Jerdon, Supplement.

*_Pomatorhinus Horsfieldi_, Sykes.

*_Saxicola nigrorufa_, Jerdon.

Dimorpha (Hodgson,) _leucura_; _Muscicapa leucura_, Latham, Swainson: adult, being the _Saxicola rubeculoides_ of Sykes.

*_Phœnicura (?) major_, Jerdon, Supplement.

*_Calliope cyana_; _Larvivora cyana_, Hodgson, _J. A. S._ VI, 102; _Phœnicura superciliaris_, Jerdon, Supplement.

*_Curruca orphea._

*_C. garrula._

Phyllopneuste rufa.

*_Acrocephalus montanus_; _Sylvia montana_, Horsfield.[*]

*_Prinia sylvatica_, Jerdon.

*_P. socialis_, Sykes.

*_P. inornata_, Sykes.

*_P. gracilis_, Franklin.

*_P. rufifrons_, Jerdon.

*_P._ —— n. s. Differs from _P. sylvatica_ in its smaller size, the less grey but more fulvescent hue of its upper-parts, shorter wings, and especially in its smaller and pale bill. Length five inches and three-quarters, of which the tail measures two inches and a half, and wings two inches and one-eighth; bill to feathers under half an inch, and above five-eighths of an inch to gape; tarse exceeding three-quarters of an inch.

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[*] Not rare about Calcutta during the cool season.

Upper-parts slightly olivaceous brown, the tail obscurely barred, and its outer feathers successively more distinctly tipped with dusky and then whitish; under parts dull fulvous-white, except on the throat and middle of the belly, which are pure white, bill pale brown, darker near the ridge of the upper mandible; legs, also, in the dry specimen, pale reddish-brown; the crown a trifle darker than the rest.

Cisticola cursitans, *Prinia cursitans*, Franklin. This small species extends into Nepâl, where there is another nearly allied to it.

* *Parisoma? vireoides*, Jerdon mutilated.

* *Motacilla variegata*, Vieillot, not of Latham do.*

Muscipeta paradisea a particularly interesting specimen, as demonstrating—what I have for some time been convinced of, from observation of the living birds, and especially their notes,—that this and the *M Indica* v. *castanea*, Auctorum, are but different states of plumage of the same species, both sexes of which attain the white garb with full maturity, though breeding before they assume this livery. In the present specimen, a male, which is only sent for inspection and exhibition, as it belongs to a friend of Mr. Jerdon, the whole under-parts, some of the upper tail-coverts, and the upper tertiaries of the wings, are pure white, the last displaying the usual black markings, while the rest of the plumage is bright chestnut, except the head and neck, which are glossy green-black as usual, and it moreover does not appear that this bird was moulting, but that the individual had thrown out this intermediate garb at the last renewal of its feathers, a few of these (among the interscapularies) being partly white and partly of the chestnut hue of reputed *M castanea* One of our taxidermists assures me, however, that he has shot a male of this species during its moult, in which the chestnut feathers were all being replaced by white ones, and mentions particularly that one only of its long chestnut middle tail-feathers had been cast, and that a new white one was growing in its place I may further add, that Mr. Hodgson has already presented the Museum with white and chestnut specimens, referring both to *M. paradisea*, and that I have seen a white male paired with a chestnut female, though more frequently pairs of the same colour associate. This bird is not uncommon in the vicinity of Calcutta at all seasons and I have seen a nest of young ones, which were dull chestnut, with merely a slight indication of the black hood.

It was necessary to enter into the foregoing details, because in Col Sykes's Catalogue of the Birds of the Deccan (*P. Z S*, 1832, p 84), it is remarked that—"these two birds have lately been erroneously considered to belong to the same species. They were never found however by Col. Sykes (who shot many,) in the same locality, nor did he observe any intermediate state of plumage. The difference between the females of the two birds noticed above at once decides the distinction of species"! Both white and chestnut-coloured individuals may commonly enough be observed in the Calcutta Botanic Garden, and frequently about thick bamboos in other districts of this neighbourhood.

Muscicapa melanops here not rare during the cool months.

**M. albicaudata*, Jerdon.

**M. superciliaris*, Jerdon; *Dimorpha* (Hodgson, but wrongly so located by me,)

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* I have lately obtained a fresh, but much injured, specimen of this bird, taken by a shikaree, and am told that it is not very rare in the vicinity of Calcutta during the cool months

albogularis, Nobis, *J. A. S.* XI, 190, where an allied species is described by the specific term *superciliaris*, which accordingly may now give place to *hyperythra*

**Pericrocotus*, (Boié, *Phœnicornis*, Swainson,) *erythropygius*, *Muscicapa erythropygia*, Jerdon, Catalogue.

**Crypsirina leucogastra*, *Dendrocitta leucogastra*, Gould

**Pastor fuscus*, Wagler, *P. Mahrattensis*, Sykes very closely allied to, but distinct from, *P. cristatellus*, which latter is here common, but appears not to have been observed by Mr. Jerdon in the peninsula

**Spermestes* ———? No. 173, *bis*, of Mr. Jerdon's Supplement. Decidedly distinct from *Sp. leuconota*, as is also Mr. Hodgson's *Munia acuticauda*, *As. Res* XIX, 153

Corypha baghaira, *Alauda Dukhunensis*, Sykes identical with the so called 'Ortolan' of this part

**Mirafra Javanica* a specimen from Madras, according very well with the description by Stephens, and a specimen from the northern part of the Deccan, sent as the *M Javanica* of Mr Jerdon's Catalogue, which, it may be, as distinct, but the variation of plumage to which these birds are probably subject, requires further investigation.

**Anthus rufescens*, apud Jerdon

**A rufula*, ditto.

**A similis*, Jerdon.

A. agilis?, Sykes, identical with the Bengalese, Nepalese, and Malayan specimens which I have hitherto referred to *A Malayensis*, Eyton. It may be either, so far as the descriptions go, which are both very deficient in the necessary measurements, and it is not unlikely that both descriptions refer to the same species, perhaps in summer and winter dresses respectively

**Cuculus sparverioides* adult and young

**C. Sonneratii*, v *C. Himalayanus* of Mr. Jerdon's Catalogue.

C. niger, Latham v doubtfully cited *C. flavus* of Mr Jerdon's Catalogue, adult male and female.

**Phœnicophæus Jerdoni*, Nobis, *Xanclostomus viridirostris*, Jerdon.

**Xanclostomus Sirkee*, *Eudynamys (?) Sirkee*, Hardwicke and Gray, and *Sirkeer Cuckoo* of Latham female.

**Cinnyris polita*, male and female.

**C. minima*, Sykes young male

**Dicœum concolor*, Jerdon

Arachnothera inornata, *Cinnyris longirostris*, Jerdon's Supplement.

Upupa epops, from the Neilgherries this bird is common in the neighbourhood of Calcutta during the cool season, but in the peninsula is generally replaced by *U. minor*.

**Chætura gigantea*, *Cypselus giganteus*, Temminck a specimen from Penang, and another which I consider to be identical in species, from the Neilgherries. Very closely allied is the *Ch macroptera*, Swainson, v. *Ch nudipes*, Hodgson, *J. A. S.* V, 779, but this has constantly the whole chin and throat conspicuously pure white, forming a large and well defined patch, and the spinous extremities of the caudal feathers are much less developed than in the other

I add a description of the specimens which I refer to *Ch. gigantea* Presumed length of the recent bird, (*i. e.* making due allowance for the skin being inordinately stretched lengthwise,) about eight inches and a half, of wing eight inches, and middle tail-feathers, to their spiny points, two inches and five-eighths Back dull hair-brown, the head, neck, wings, and tail, dull iridescent black, and under parts brownish, tinged with the same, especially about the breast, under tail-coverts, and line along the sides reaching to them, white; and chin slightly albescent, the loral feathers still less so This description is taken from the Penang specimen, the Neilghierry one being a trifle less in length, its wing measuring seven inches and a half, and tail two inches and five-eighths The chin is whiter than in the other, and the loral feathers are also white, but there is no other difference

**Cypselus alpinus*, vel *melba* from the Neilghierries

**C. australis (?)*, Gould, *P. Z. S.* 1839, p 146, or a closely allied species, having the tail above half an inch shorter than is stated in the description cited from Penang. Length about six inches and a half, of wing seven inches, and outer tail-feathers two inches and seven eighths, the medial two inches and a quarter. General colour dusky-brown overlaid with shining green-black, the feathers of the breast and belly margined with whitish, rump white, having dusky shafts to the feathers, and throat and fore neck whitish, being similarly shafted.

C —— ? A specimen from the Deccan, only differing from the last in being smaller, generally somewhat browner, particularly on the head and nape, and in having the abdominal feathers more slightly margined with whitish the foot is, however, so decidedly smaller, that I cannot regard it as the young of the preceding species, bending the hind-toe backward, the span barely exceeds five-eighths of an inch, whilst in the other it is fully seven-eighths of an inch. Length five inches and a half, of wing six inches, and outer tail-feathers two inches and a half, the medial an inch and three-quarters.

C affinis, Hardwicke and Gray. A Neilghierry specimen is also sent as different from this, but which appears to me to be only the young of *affinis* Length of wing four inches and three-quarters, and of tail an inch and five eighths. Colour more brownish and less glossed than in the adult *affinis*

**C. concolor*, *Hirundo unicolor*, Jerdon, Catalogue, but since correctly referred in the Supplement to the latter to the present genus, wherein already a distinct *C unicolor*, from Madeira, has been figured and described by Messrs Jardine and Selby, in their 'Illustrations of Ornithology,' Pl. LXXXIII, for which reason I have altered the specific name bestowed by Mr. Jerdon on the present species

**Hirundo domicola*, Jerdon, Supplement

**H. urbica* from the Neilghierries.

**H. inornata*, Jerdon, Supplement.

**H concolor*, Sykes.

**Vinago aromatica*, female, being the *V. affinis*, Jerdon, Catalogue, where the *V unicolor*, Jerdon, is likewise the female of *V. bicincta*, Jerdon.

Carpophaga ænea

**Ardea nigra*, Vieillot.

A lepida, Horsfield

Porzana rufescens, *Rallus rufescens*, Jerdon also met with in the vicinity of Calcutta

**P.* —— ? New species Allied to the last, but smaller, and otherwise differing.

Gallinula chloropus (?), var. *Indicus*, male, sent as *G akool*, Sykes. This bird is common enough in the vicinity of Calcutta, and it appears to me, judging from memory, to be constantly inferior in size to the British species. As in the latter, the female is larger and much finer-coloured than the male. A handsome adult female measured twelve inches and a quarter long, by nineteen inches and a half in spread of wing In Dr. Fleming's 'British Animals, the dimensions of the European bird are given as — "Length fourteen inches, breadth twenty-two inches", but Mr. Jenyns assigns only thirteen inches by twenty inches and three-quarters, which are probably the admeasurements of the European male bird In other respects there appears to be no difference whatever

Machetes pugnax, sent as *Tringa Hardwickii*, Gray, which is evidently the Ruff in winter dress, as *T. Indica*, Gray, is the female or Reeve

**Charadrius russatus*, Jerdon.

**Strepsilas interpres.*

From the Barrackpore Menagerie, we have received a specimen of a young Sambur Deer *(Cervus hippelaphus)*.

I now proceed to describe the small Bootan Squirrel, which has been already mentioned (p. 880) as being nearly allied to *Sciurus insignis*, Horsfield, and to the Neilgherry *Sc Delessertii*

Sc Pembertonii, Nobis Total length nine inches, of which the tail with its hair measures four inches, tarsus, to end of claw of longest toe, an inch and one-eighth. General hue of the fur dull brownish-fulvous, grizzled with black, and slaty-black at base, under-parts albescent-brown a black stripe on the nose, anterior to the whiskers which are also black, another black mesial stripe commences between the shoulders, and is continued to the croup, besides which is a narrow lateral black stripe, adjoining a broader pale fulvous one external to it, which commences on the side of the neck, and is continued to that of the base of the tail, becoming narrow over the croup the ears are rather small, and are lined internally with minute close fulvous white hairs, their edges are black, and the fur outside the ears is longer, and terminates in a white tuft which shews conspicuously, contrasting with the black edge of the ear The tail is grizzled nearly like the back, but black predominates on its upper surface, and fulvous on the lower orbits fulvous; and feet coloured like the sides

I may also here describe another small rodent, presumed to be from the Himalaya, which I shall designate

Georychus fuscocapillus, (vide *J. A. S* X, 928), or Dusky-capped Lemming. Length about four inches, exclusive of the tail which measures a quarter of an inch, or with its hair half an inch tarse, to end of claw of longest toe, seven eighths of an inch. Ear-conch very minute, and concealed underneath the fur the latter is of an Isabella colour at the surface, or nearly that of *Bathyergus maritimus*, but slaty-black for the basal two-thirds, the upper part of the face and head being dusky brownish-black, which gradually passes into the hue of the body whiskers reaching to the ears, a few of the anterior being whitish, and the rest dusky The rodential tusks of this species are pure white, and the upper pair project very remarkably forward

Having taken a fortnight's excursion up the river since our last Meeting, and gone much on shore to observe and collect whatever fell in my way, a few remarks on the

Zoology of the district as observable during the latter part of July, when the rainy season has moderated, though heavy showers are still of frequent occurrence, leaving periods of sunshine at most but of a few hours' duration, may be acceptable to some readers of the Journal in Europe, who may not be prepared to hear of the remarkable paucity of animals which fell under my observation, in a region so generally understood to teem with animal life at all seasons.

I may notice that, keeping on shore almost constantly while the weather permitted it, I did not advance above fifty or sixty miles above Calcutta; the country being almost everywhere so thickly populated that it was dangerous to point a gun near the ground: to this cause, however, must not be attributed the scarcity of birds in particular, so remarkably noticeable during the epoch of the rains, for the contrast in this respect presented during the cold season is very striking.

There was a total absence of water-fowl upon the river; and the only species of wading or water-fowl observed on land, were a few Egrets *(Paddy-birds)* of different species in the rice-fields, with occasionally an *Anastomus* seen on the wing, and now and then a solitary *Ardea Javanica* would be put up from secluded tanks generally surrounded by jungle; I also observed two or three individuals of the larger Whistling Duck *(Dendrocygna major,* Jerdon*)*, a pair of the Pygmy Greenshank *(Totanus Horsfieldi)* on the margin of a brook, and the only *Rallidæ* seen were two or three individuals of *Gallinula Javanica* vel *phœnicura.*

The *Raptores* were not more extensively represented. The White-backed Vulture (*Vultur leuconotus*, of which *V. Bengalensis*, Auct., is merely the young,) was duly numerous, collected wherever there was, or had been, aught to entice its appetite, or sailing in quest of such delicacies high in the bright sunlight. The *Haliæetus Pondicerianus* ('Brahminee Cheel'), so very numerous at other seasons, was seen only once or twice; and the common Indian Kite *(Milvus cheele)*, which literally swarms in Calcutta during the greater part of the year, quits it entirely at the time of the rains, and of this I saw two or three individuals high in air: the only remaining bird of prey observed was *Circætus undulàtus*, a pair of which were hovering over Barrackpore park, and another was shot some miles higher up the river.

There are five species of Parrot more or less common in this neighbourhood throughout the year; viz. *Palæornis Alexandrinus, torquatus, mystaceus,* and *Bengalensis,* and *Psittacula vernalis. Pal. torquatus* is the most numerous, and *P. Bengalensis* next so; these I have marked down in my list as having been observed on the present occasion, as also a large flock of what appeared to be the little Crimson-rumped Lorikeet *(Psittacula vernalis).*

Of Woodpeckers, *Picus Bengalensis* is extremely abundant at all seasons, and *P. Macei* less so: in addition to these was obtained *P. badius*, Raffles, which is not common in this part of Bengal, though I had before observed it. Of Cuckoos, *Cuculus fugax* was numerous, *Oxylophus edolius* less so, and *Centropus Phillipensis* common. *Bucco cyanops* and *B. Phillipensis* abundant. The Kingfisher tribe was as plentiful as at other seasons, consisting of *Halcyon Capensis*, tolerably common, *H. Smyrnensis, Ceryle rudis,* and *Alcedo Bengalensis:* the fine *Halcyon amauropterus*, Pearson, *(J. A. S.* X, 635*)*, which is tolerably common near Calcutta during the cool season, I did not observe. The Roller *(Coracias Indica)*, so very plentiful in the cool months, had almost disappeared: and the pretty little green Bee-eater *(Merops*

Indicus), which during the cool season is one of the very commonest birds we have, had not been once seen by me for two or three months in places where it had abounded, when in the course of my late excursion I observed three or four upon one occasion hawking over a paddy field. Of Swifts, we have two species common throughout the year; viz. *Cypselus affinis*, Gray, which frequents towns, and is chiefly seen in their immediate neighbourhood, and *C. palmarum* which mainly affects rural districts, building its nests within the fronds of the fan-leaved palms, sometimes twenty or thirty pairs of them associating in those of a single tree, while it is also rare to meet with one of the same palms clustered with the pensile nests of the Baya, (*Euplectes Phillipensis,*) that does not also harbour two or three pairs of this elegant little Palm Swift.

Among the perchers, the common Indian Crow (*Corvus splendens*, Vieillot), the common Mynah *(Pastor tristis)*, and the common House Sparrow *(Pyrgita domestica)*, were, of course, everywhere abundant about habitations. No other Mynah or allied bird fell under my notice, except the Pied Starling *(Sturnus contra)*. The Indian Black Crow *(Corvus macrorhynchos)*, was here and there seen along the river bank; *Crypsirina vagabunda* in the trees. In the various green lanes, orchard-gardens, and other most likely places to meet with small perching birds in general, scarcely a chirp could usually be heard, and not a bird be seen for perhaps five or ten minutes together: but *Columba tigrina* was numerous in most places, perpetually uttering its coo, and about the most conspicuous feathered inhabitant of this part of Bengal throughout the year is the gregarious and noisy *Malacocercus, terricolor*, (Hodgson, here called *Chatarrhœa*, or, oftener, *Saat Bhye*, vide *J. A. S.* X, 650); the tiny but loud chirping Tailor-bird *(Orthotomus Bennettii)*, and the various-chirping *Iora typhia* vel *scapularis*, are other conspicuous species at all seasons; also the Indian Black-headed Oriole *(Oriolus Hodsonii*, apud Swainson), and two species of Bulbuls *(Hæmatornis* of Swainson, the *Ixos Cafer* and *I. jocosus*, Auctorum). The assemblages of Bayas *(Euplectes Phillipensis)* all but invariably select a fan-leaved palm wherefrom to hang their curious and beautifully constructed nests, preferring the immediate vicinity of human abodes; but on one occasion I noticed a number of these pensile nests upon two small exogenous trees, which stood alone near the margin of a rice-field. Small flocks of *Pyrrhulauda crucigera* were occasionally put up in the rice-fields; and among conspicuous species should not be omitted the Fingah *(Dicrurus Fingah)*, though it appeared to be considerably less numerous than at other seasons; the Butchanga of the Bengalees *(D. æneus)* was likewise met with. The Dial *(Copsychus saularis)*, whose pleasing song reminds one of the Robin of Europe, though inferior in quality, being intermediate to that of the British Robin and Redstart, was also frequent; *Muscipeta paradisea* seen now and then; small troops of *Pericrocotus peregrinus* not rare; and the restless Dusky Fantail *(Rhipidura fuscoventris)* moderately common; this bird has a very pleasing, short and tinkling, song. I obtained one specimen of *Tephrodornis superciliosus;* and observed two or three individuals of *Anthus agilis*, which in the cool season is most abundant. Finally, upon the blossoms of the cocoa-nut palms, were seen feeding the brilliant little *Cinnyris sola*, which was tolerably plentiful, its weak chirp and song recalling to mind those of a *Regulus*, and the dull-coloured *Dicæum Tickelliæ*, Nobis (or *Nectarinia minima*, Tickell, *J. A. S.* II. 577), which was less abundant. *D. ery-*

thronotum had also been procured by me a few days previously to this small excursion.

The foregoing brief list comprises all the species of birds I remarked, during daily rambles of several hours; and very scantily were they, in general, dispersed. Of mammalia, the common species were, of course, the Jackal, and the Palm Squirrel and Musk Shrew about habitations. I obtained the *Gerbillus Indicus*, for the first time I had seen it from Bengal, and learned that it was not uncommon about rice-fields. Of Bats, nothing new was met with, at least additional to what I have procured in the immediate vicinity of Calcutta. I observed the Hoonuman Monkey (*Semnopithecus Entellus*) in great numbers, along the banks of a nullah about fifty miles from this metropolis; scarcely less tame than domestic animals, and a great annoyance to the villagers whom they plundered incessantly. As soon as my boat was moored, the trees around and almost hanging over were crowded with them, peering with curiosity, though not unmixed with distrust; nor without due cause, for desirous of getting a fine specimen for the Museum, I soon brought one down, and the villagers, to my considerable surprise, gave every encouragement to shoot others, although themselves would not think of doing so. The sacculated stomach of this individual was quite filled with *finely masticated foliage*, a diet which the conformation of the molar-teeth and stomach in this genus had led naturalists to suspect these animals more or less resorted to,* though the actual fact of their doing so had not, I believe, previously been ascertained. These Monkeys were perfectly at home upon the huts of the villagers, and their surprising agility recalled forcibly to mind M. Ruppell's description of the habits of *Colobus Guereza.*† Their deep and loud, heavy voice, calling to one another among the trees, could be heard to a great distance.‡

Of Reptiles, I scarcely met with anything. The pretty *Calotes Tiedmanni* was now and then seen, and once a sort of Scinque, under a fallen tree, which I failed in secur-

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* Vide Mr Owen's paper on the stomach of the present species, published in the Zoological Society's *Transactions*, Vol. I.

† The *Colobi* have recently been ascertained by Professor Owen to resemble the *Semnopitheci* in the conformation of the stomach.

‡ The following very interesting observation relative to the habits of the *Semnopithecus Entellus*, I quote from the 'Bengal Sporting Magazine' for August 1836, page 93.

"In the extensive jungles which exist in the Burdwan district, the large black-faced Monkey, the *Honooman* I believe of the natives, is found in considerable numbers, as also in the topes or groves which are scattered over the cultivated parts of the country: which latter circumstance has afforded the means of remarking the curious method which is observed by these animals, for regulating the sexual intercourse of the species. The Monkeys are always found in packs occupying particular trees, and it is remarkable that, in each, only one adult male will be found; the remainder consisting of females and their young. It is also surprising that this individual should exhibit great animosity towards the male young, pursuing them on every occasion, and never failing to destroy them when they unfortunately fall into his power. To obviate this, the mothers make use of many ingenious expedients, keeping their progeny as much as possible out of sight, and when hotly pressed, throwing them from one branch to another into the hands of other she-monkeys, who take charge of them with as much solicitude as if they were their own. The young female monkeys, on the contrary, are not molested in the least.

"At a particular season of the year, the great body of he-monkeys, which had been leading a monastic life deep in the woods, sally forth to the plains, and mixing with the females, a desperate conflict ensues for the favours of the latter. This continues for several days, at the end of which ing. A large Cobra was observed swimming in the river, but no other snake whatever. Of *Batrachia*, I procured a few Tree-frogs (*Hyla maculosa* of Hardwicke and Gray), which passed the day asleep upon low herbage; also a species of Toad undertermined, additional to that common about Calcutta, and the young of a third species.

Of Fishes, nothing but what is common in the Calcutta bazars.

A few *Testacea* and *Crustacea* were collected, and a considerable number of fine Insects, particularly *Orthoptera* and *Lepidoptera*, but not many species additional to what I had previously met with.

Such is a brief summary of the products of a fortnight's quest for specimens to enrich the zoological collections in the Society's Museum, undertaken, however, chiefly for purposes of observation, to which collecting was regarded as subservient. Of course there were many species which eluded observation, but fewer of birds than of the other classes, whence my list of these will tolerably well illustrate what are to be met with in this part of Bengal at the season when birds are rarest. The frequency of the rain was a great impediment to carrying on any researches of the kind, by rendering many places impassable alike under-foot, and drenching the bushes and under-wood, so that traversing them was as bad as experiencing the effects of a shower; but my little party did their best towards securing whatever they could for the Museum, and while the showers fell, there was work enough inside the boat in preparing what specimens had been collected. I do not, however, recommend any other party to select the same season for similar investigations.

With much respect,
I now subscribe myself,
Yours obediently,
EDWARD BLYTH.

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time, one male, more valorous or strong than the rest, will be found in possession of the whole female part of the flock, his discomfited fellows remaining at a short distance from the scene of their defeat. An interesting scene now follows: a kind of conference takes place, the female monkeys delivering up their half-grown male offspring to the care of the former, who troop away to the jungles, reinforced by the juniors, who at the next season return with their foster fathers to take part in the contests which ensue on their periodical migration."

Though rather out of place here, I shall cite another observation from the same work (for September 1836, page 158), relative to the habits of the Rhinoceros, concerning which it would appear that the nasal horn is not the most formidable weapon of this powerful beast. "At one time," remarks the writer, "I thought it was so, but have long been satisfied that it is merely used *in defence*, and not as an instrument of offence. It is with the tusks they wound so desperately. I killed a huge male, which was cut and slashed all over its body in fighting; the wounds were all fresh, and as cleanly cut as if they had been done with a razor,—the horn could not have been used here. Another we had wounded, stood, and out of pure rage, cut at the jungle right and left, exactly as a hog uses his tusks. One of my friends had a man, who was sauntering through the forests, actually embowelled by a Rhinoceros. He examined the wound immediately, and I heard him say afterwards, that, had it been done with the keenest cutting instrument it could not have been cleaner cut;—that could not have been with the horn." Other facts to the same effect have been related to me by a sporting friend, who has had considerable experience in Rhinoceros hunting; and since transcribing the above, I see that Mr. Robinson mentions, in its 'Descriptive account of Assam,' p. 97, that "the Rhinoceros makes no use of its horn as a weapon of defence, but for this purpose invariably uses its teeth."

I may also here notice, that I have just ascertained the fact of *a plurality of species* being, there can be no doubt, confounded under the appellation of *Hoonuman*, which greatly detracts from the value of what had been hitherto ascertained regarding the geographic range of the alleged *Semnopithecus Entellus*. January 20th, 1843.—E. B.

Read the following letter from the Curator of the Museum Economic Geology.

H. TORRENS, ESQ. *Secretary, Asiatic Society.*

SIR,—Upon examining the official reports of the late Dr. Voysey, I learn, that with that of 8th August 1821, (Cons. of 21st August 1821,) he forwarded a Geological Map, which was soon after sent to the Honorable the Court of Directors. No record appears of any copy having been made to retain here.

I beg therefore to suggest, that the Society apply to Government to obtain for us copy of this and any other of Dr. Voysey's Maps or Plans, as being documents of the highest possible importance to us, and in fact, almost the only existing materials we have for a Geological Sketch Map of much of that part of India.

I am, Sir,
Your obedient servant,
H. PIDDINGTON,
Curator Museum Economic Geology.

A copy of the foregoing letter was forwarded to the Secretary to the Government in the General Department, on the 27th August last, with a request that copies of the Geological Maps of Dr. VOYSEY alluded to, may be procured from the Honorable the Court of Directors, for the use of the Museum Economic Geology. The Secretary reported, that assurances had been held out for a compliance by the Government with the request of the Society.

Read the following report from the Curator Museum Economic Geology:—

Report of the Curator Museum of Economic Geology for the month of August.

Museum Economic Geology.—I announced in my last report an ore received from Major Ouseley, Agent to the Governor General S. W. Frontier. As I supposed, it has proved to be an argentiferous ore, of sulphurets of lead and antimony in varying proportions, with iron pyrites in a quartz matrix. I obtained from 500 grains of the ore, fairly taken as an average, one and a half grain of muriate of silver, equal to one grain of pure silver. This would give about 70 oz. of pure silver to a ton of well picked ore, which in England would be worth working. I have written to Major Ouseley for more specimens, (those sent being merely the out-crop of the vein,) when we may perhaps find ores of a quality better worth attention; the presence of the antimony being a favourable indication.

We have received from Miss Lloyd, (Darjeeling,) a white earthy powder found in the bed of one of the mountain streams, and used by the Lepchas to whitewash their houses. Upon analysis, this substance is found to be composed of

In 100 Parts.	Carbonate of Lime, ...	55.20
	Carbonate of Magnesia, ...	19.04
	Alumina, ...	6.00
	Silex, ...	8.00
	Iron, ...	None
		98.24
	Loss, ...	1.76
		100.00

In a separate report on this mineral, addressed to our Secretary, I have pointed out the importance of examining the sediments below these deposits, and the river courses above them, so as to trace the rock, and to ascertain if any metallic ore exists in it or in the sediments.

The earthy deposits would make good lime, which is so great a desideratum at Darjeeling.

From Government we received in July, (in which month's report it was omitted by an oversight,) a report by Captain Campbell, Assistant Surveyor General, on the Natural History of Southern India, with two specimens manufactured by himself, from the iron sand of that quarter.

Our zealous member, G. T. Lushington Esq. Commissioner, Kemaon, has also sent us a valuable collection of sixty-four specimens of ores of iron, copper, and lead from Kemaon, which, with the foregoing, are upon the table.

From Mr. Garnior, Engineer, through our Secretary, we have received a specimen of the rose-coloured sienitic granite of the interior of the Pyramids, and one of the limestone from the exterior of them.

Geological and Mineralogical Museum.—I have been continuing the arrangement of the minerals, and we have received herein from the Reverend J. H. Pratt, Chaplain to the Lord Bishop, an excellent little series of fifty-six Geological specimens from Gwalior to Jubulpoor in Bundlecund, comprising several curious and instructive specimens of the Geology of that interesting tract of country.

From Mr. Garnier also, we have a specimen of fossil wood, from the large deposit of it in the Desert between Cairo and Suez.

H. Piddington,
Curator Museum Economic Geology.

No. 465.

To H. Torrens, Esq.
Secretary to the Asiatic Society.

General Department.

Sir,—I am directed to transmit to you, for the Museum of Economic Geology, the accompanying copy of a Letter and Report by Captain Campbell, Assistant Surveyor General at Madras, on the manufacture of Natural Steel in Southern India, received from the Government of Madras, together with the specimens of Steel therein referred to.

I have the honor to be,
Sir,
Your most obedient Servant,
H. V. Bayley,
Deputy Secretary to the Government of India.

Council Chamber, *the 15th June,* 1842.

No. 496.

Fort St. George, 30*th May* 1842.

To the Secretary to the Government of India.

Public Department.

Sir,—I am directed by the Right Honorable the Governor in Council, to transmit to you, for submission to the Supreme Government, copy of a report upon the manufacture of Natural Steel in Southern India, received with the accompanying letter from Captain Campbell, Assistant Surveyor General, dated 9th instant.

I have the honor to be &c.

(Signed,) H. Chamier,
Chief Secretary.

(Copies.)

To the Secretary to the Government of Fort St. George, in the Public Department.

Sir,—With reference to a report in October 1841, I have the honor to forward a report on the "Manufacture of Natural Steel in South India," which I request may be laid before His Lordship, the Right Honorable the Governor in Council.

2. Accompanying I have also forwarded a small piece, as a sample, of this steel in the rough state, after having been forged, on removal from the furnace; as also a piece made up into the shape of a Native carpenter's chisel, which has been in use long enough to prove, that the steel will bear a temper as good, if not better, than that of similar articles made in England.

3. The purposes to which this steel might be applied, and in which the Government must now expend vast sums of money are very numerous; viz. ramrods for muskets, axes, bill-hooks, and jumpers for the corps of Sappers and Miners, the various tools of artificers, &c. &c. all of which could be made with iron and steel manufactured in India, for very much less than they now cost from England.

4. With reference to my proposal to undertake to manufacture iron, I shall be happy at the same time to undertake to supply this steel at the rate of 150 rupees per ton, and in quantities probably as large as can be required.

5. I have the honor to remark, that in specifying the above rate for the cost of the manufacture of this steel, and also of the iron, without requiring any further outlay on the part of Government, I have been guided by the *certain* results of my experiments, so as to secure myself against any loss, and do not deny, that the rates mentioned, will probably afford me a very handsome remuneration; but that should His Lordship, the Right Honorable the Governor in Council, be pleased to have sufficient confidence in my knowledge and information in the various branches of physical science, to recommend that I should be employed to institute the manufacture in question, at the risk and immediate expence of Government, I shall be happy to endeavour to economise the expence of manufacture to the lowest possible rate, which I am led to believe might be reduced as low even as 60 rupees per ton, as I hope in that case that there may be no objection to a proportionate increase of my monthly salary.

6. In presuming to propose the institution of my manufactures in question, I am quite aware that it has been stated as a dogma by political economists, that it is objectionable for a Government to meddle with the manufactures of a country, or to attempt unnatural fostering of any particular branch; but with deference, I beg to be allowed to suggest, that a sufficient distinction has sometimes not been made between fostering a trade, and fostering the dissemination of the knowledge necessary

to establish, or to improve a trade. In Europe, of course the latter can never be requisite ; but in the present state of India, I believe it will be allowed, that without the fostering aid of Government, no new manufacture can be introduced in which natives of the country may be expected to participate.

7. In the present instance there is no one acquainted with the theory or practice of the processes which I employ, and even if they were well known in Europe they could never be put in practice in India ; because being very simple, it is more than probable that in less than five years, the natives will have learned and taken them out of the hands of the first institutors, while the modes of manufacture common in England, which from the great expence of the furnaces, &c. required, are retained in the hands of capitalists, cannot be generally employed in India, in consequence of the manner in which the ore and fuel are distributed through the country.

I have the honor to be, &c.

(Signed) J. CAMPBELL, *Capt. Assistant Surveyor General.*

RYACOTTAH, *9th May* 1842.

Report upon the manufacture of Natural Steel in Southern India. By Captain CAMPBELL, *Assistant Surveyor General, Madras Establishment.*

1. In England, steel is made by cementing bars of Swedish or Russian iron, at a high temperature, while embedded in powdered charcoal. In this manner the cheapest kind is produced called " blister steel."

2. By drawing out this steel into small bars under a " tilt hammer," the quality is much improved, and it is then called " tilted steel ;" and by combining bars of " blister steel" at a welding heat, and drawing them out under the hammer, " shear steel" of still better quality is formed, and by fusing pieces of blister steel together in a crucible " cast steel" is produced, which is the finest kind of steel made in England.

3. The wholesale prices of the above varieties of steel in the English market vary from 30 to 80*l* per ton, and blister steel is sold at Madras in retail, at the rate of 560 rupees per ton.

4. In Mysore, steel is made by a process which admits of considerable improvement, and is sold in retail at the rate of 373 rupees per ton. In quality this steel is sometimes far superior to any English steel, but as considerable practical knowledge is required to select the good from the bad, and as the quality is very uncertain, it is not probable that while the manufacture remains in the hands of natives, it can ever supersede the use of English steel.

5. The cheapest steel made in India, sells at about 233 rupees per ton, and being of very inferior quality, it is only used by the natives for making axes and bill-hooks.

6. In Germany and Styria, a kind of steel has long been made, by treating cast iron in a particular manner, called " natural steel," or " German steel," which at one time was imported largely into England, and is still used on the Continent, in

consequence of its cheapness, for all rough purposes, such as tipping ploughshares, making axes, &c. &c.

7. This kind of steel is not made in England, in consequence of the bad quality of the iron made from the commoner ores of England.

In a former report, I have shewn that this "natural steel" can be produced immediately from the ore in smelting the "iron sand" of South India, at a very cheap rate; but on further investigation of the process, I have found that by treating the cast iron procured from this ore, in a manner similar to the German methods, a natural steel can be produced without any uncertainty in the result, for less than 150 rupees per ton, which is less than iron now sells for in South India.

9. By experiments on steel which I have made in this manner, I have found that it is fitted for every purpose for which natives now use steel, while the process is so very simple, that it can be learned and practised by natives with very little difficulty, and the apparatus requisite costs hardly any thing.

(Signed,) J. CAMPBELL. *Capt. Asst. Surveyor General.*

RYACOTTAH, *9th May,* 1842.

(True Copies.)

(Signed) H. CHAMIER, *Chief Secretary.*

(True Copies.)

H. V. BAYLEY, *Dept. Secy. to the Government of India.*

ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the

Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the remarkable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to number at present only, we are able to estimate the riches of the whole creation, and to explain the alterations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after, the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°, with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

HERMANN VON MEYER.

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A Monograph of the Indian and Malayan species of Cuculidæ, or Birds of the Cuckoo family. By EDWARD BLYTH, *Curator of the Asiatic Society*

In the present state of Indian Ornithology, there is nothing so much required, as a series of carefully prepared monographs of various groups, in which the object should be less to describe new species, than to attempt an analysis of those which have been already made known, more or less satisfactorily, by numerous writers, whose information at present lies scattered in a great variety of works, many of difficult access, and others in which few would think of looking for notices of the kind. In proceeding to offer a series of such monographs, I am quite sensible of my own deficiencies, arising alike from a paucity of expensive works of reference, and from the circumstance of my having so recently commenced the more especial study of Indian zoology; but, on the other hand, the peculiar advantages of my position afford considerable facilities for the undertaking, and I am desirous to commence at once, and publish with as little delay as practicable, such information on many groups as will enable students of zoology in this country to turn their observations to more account, by letting them know whitherto their attention can be advantageously directed, hoping th to elicit from them those various additional details, which, were postpone the publication of these monographs until my own r should have supplied me with all such desiderata, ther be little chance of their ever appearing at all, and even if t it is very doubtful whether they would prove to be of as much practical utility.

The species of Indian *Cuculidæ* are rather numerous, and to these I shall first invite the attention of our zoologists, commencing with those members of restricted *Cuculus*, which, like the included European Cuckoo, have short and half-feathered tarsi—alone a sufficient indication of this particular group.

In the European species of this genus, the sexes are usually similar, though the female has generally some trace of barred markings on the sides of the neck, which are likewise present in a few of the young males of the preceding season, while they are absent in some old females; but I have seen one instance, and heard of others, wherein the adult (presumed) female of *Cuculus canorus* has been entirely clad in a barred livery, quite different from that of the young, and corresponding to the garb which seems to be the ordinary one of certain of its allied Indian congeners, in which state it has been described as a separate species by the name of *C. hepaticus*. A specimen of this kind has been noticed by my friend Mr. Thompson of Belfast, in the 'Proceedings of the Zoological Society' for 1834, p. 29; it was killed at the end of May, as was likewise that which fell under my observation; and it seems probable that the converse occasionally obtains with certain of the Indian species, some females of which may resemble the mature males in plumage, while perhaps the latter in some instances, at least on casting their first or nestling feathers, may assume a dress resembling what in them is the ordinary one of the other sex; this remains to be certified by actual observation.

At least five species of typical *Cuculus* inhabit this country, two of them being characterised by having a shorter and less graduated tail, and markings on the under-parts, which, as observed by Mr. Jerdon in the instance of one of them, have the same character as those of the Hawks, being longitudinal in the young bird, and becoming transverse with age: such are—

1. *C. sparverioides*, Vigors, *P. Z. S.* 1831, p. 173; — Gould's *Century*, pl. LIII.* (ACCIPITRINE CUCKOO.) Length about fifteen inches;

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* Probably also the "Ferruginous-necked Cuckoo" of Latham, *Gen. Hist.* III., 269, though differing in the colour of the bill and feet, and in having the wings of ordinary length.

of wing eight inches and a half; and middle tail feathers eight inches, the outermost an inch and a quarter shorter; bill to forehead (through the feathers) an inch and one-sixteenth, and to gape an inch and a quarter; tarse seven-eighths of an inch. General hue of the upper-parts (in the specimen before me) a bronzed dark brown, but slightly tinged with ashy, though I think it probable that older birds would be greyer: crown, occiput, and sides of the upper-part of the neck, very dark ash-colour; the sides and front of the lower-part of the neck bright ferruginous, marked a little with dark ash, and white at the bases of the feathers; chin dark ashy, the throat white streaked with the same, mingled with rufous; lores also whitish: under-parts from the breast fulvescent-white, transversely streaked with dusky, but the vent and lower tail-coverts pure white, with one or two dark bands on only the longest feathers of the latter: tail of a paler brown than the back, and crossed with five dark bars, one of them basal, another subterminal (which is very broad), the extreme tip being whitish, and the penultimate dark bar much narrower than the others; the space immediately bordering the dark bars beyond them being paler than the rest and rufescent: primaries and secondaries obscurely marked on their outer webs with narrow bars of dull pale fulvous, and on their inner webs banded with white internally. Bill dusky horn-colour, with some yellow on the lower mandible; " the irides and feet both pale gamboge-yellow, the feet with a slight buff tinge" (Jerdon). A young specimen has all the upper-parts transversely barred with rufous, except the crown which is dark ashy without markings: under-parts fulvous-white, each feather having a mesial blackish streak: there are six dark bands upon the tail, and the rufous colour bordering them is more developed than in the adult: the head and throat are nearly as in the mature plumage.

Both this and the next species are included in the catalogue of Dr. Royle's birds procured at Saharunpore and in the Himalaya, as migratory, appearing in March; and the present would seem to be chiefly a mountain species. I have not yet met with it in Bengal, but Mr. Jerdon has lately procured two specimens in peninsular India, from which I have drawn up the foregoing descriptions. Of its particular habits and notes I can say nothing.

2. *C. fugax*, Horsfield, *Lin. Trans.* XIII. 178; *Bhrou* (i. e. *burra*

or large) and *Bychan Cuckoo,* and the young—*Sokagu Cuckoo,* of Latham, *Gen. Hist.* III., 264-5; *C. Lathami,* Hardwicke and Gray; *C. radiatus* (?), Gmelin, or *le Coucou brun et jaune à ventre rayé,* Buffon, *Hist. Nat., Ois.,* VII., 379.* (WHISTLING CUCKOO.) Length thirteen inches and a half, by twenty-two inches in extent; wing from bend seven inches, and tail six inches and three quarters; its outermost feathers an inch and a half shorter than the middle ones: bill an inch and one-sixteenth to forehead (through the feathers), and an inch and a quarter to gape; tarse three quarters of an inch. Colour of the upper-parts uniform ash-grey, the winglet and coverts of the primaries darker: fore-neck and breast pale rufous, each feather light-grey in the centre: belly and flanks white, barred with adjoining lines of grey and rufous; the white hardly visible anteriorly, from the overlapping of the feathers: thighs, vent, and lower tail-coverts, pure white; the first a little barred: throat grey, and some white at the base of the bill and sides of the throat: tail grey, tipped with faint rufous and finally whitish; having a broad dusky subterminal band, and five other narrow undulating zigzag bands (one near the base), composed of a dusky bar and then a whitish one adjoining, with some traces of rufous: quills barred with white on their inner webs for the basal two-thirds or three-fourths of their length: bill dusky, the lower mandible, except at its extreme tip, and the sides of the base of the upper one, wax-yellow: orbits brilliant gamboge-yellow; irides the same: feet comparatively dull yellow. An adult female had the bill pale-greenish at the basal half of the upper mandible, and on nearly the whole of the lower mandible, the rest being dusky; irides brownish-yellow. Size exactly that of the male, and plumage only differing in being less vividly coloured, the breast mottlings dingy and indistinct. The young have the irides paler and greenish; the usual rufous barring of the upper-parts not very distinct, being almost obsolete on the back, and chiefly visible on the wings and about the nape; head ashy; and the longitudinal markings of the lower-parts much less dark than in the preceding species. Very young birds have the bill wholly yellow.

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* Since writing the above, I have seen Sonnerat's figure of his *Coucou à ventre rayé de l'Isle Panay,* and am less inclined to identify it with *C. fugax* than I was previously. It is described to be nearly as large as the European species, *having an even tail:* "the upper part of the head of a blackish-grey; throat and sides of the head vinaceous *(couleur de lie de vin)*; breast dull orpiment-yellow, the belly faint yellow, *and both barred with black*; back and wings dull brown-black; the tail composed of feathers of even length, tipped with white, *and marked with series of white round spots* [upon the shafts], so arranged as to form [interrupted] bars: bill black; the irides pale orange; and feet reddish." Dr. Buchanan Hamilton referred the *C. fugax* to this species; and it appears that the latter has never been verified as distinct, to judge from every succeeding writer having copied from his predecessors.

One of the specimens referred by Latham to his *Sokagu* is described as having "the under-parts of the body to the thighs pale slate-colour," while the description of the back suits very well the young of *C. fugax*: another has "the body beneath pale ash-colour, marked with roundish black spots on the sides of the neck and body"; and a third has "all the under-parts dusky-white, marked with longitudinal streaks of pale brown," which agrees with all the young of *C. fugax* which I have seen no inconsiderable number. It remains for future observers to substantiate these various indications, which however, mostly resting on drawings of more or less questionable fidelity, their value is thereby much deteriorated.

This Cuckoo, originally discovered (if identical with *radiatus*) in the Phillipines, and since observed in Java by Dr. Horsfield, is very common in Bengal, and apparently throughout India—equally so with the British Cuckoo in England. It feeds largely on fruit, especially (as remarked by Mr. Jerdon) on the small figs of the banyan tree, but it also preys on caterpillars and other insects. It is a noisy bird, and has two or three different notes, the most remarkable of which is the shrill whistling *crescendó* note adverted to by Mr. Jerdon, and which Mr. Elliot endeavours to express by the sound "*whe-wheewa, whe-whee-wa, whe-whe-e-wa,* uttered eight or ten times, and sometimes oftener; at first lower, and gradually rising till the later repetitions become extremely loud and shrill;"—indeed, so much so, that it is impossible for one's attention not to be aroused by it, and the bird often delivers this cry perched conspicuously upon a bare branch near the top of a high tree, being answered to, at times, by others, and not unfrequently two or three of them may be heard engaged in noisy contest, emitting then a continuously reiterated squeaking cry, which also increases gradually in loudness. This bird is the *Choke-dello* of the Bengalees, a name meant to be imitative of its note, but which is not very expressive of it.

3. *C. canorus*, Lin. (The EUROPEAN CUCKOO.) This species is tolerably common on the Himalayas, and Lieut. Tickell informed me that it is not rare in the jungles of Borabhúm and Dholbhúm, but Mr. Jerdon states that "it is seldom met with Southward of North latitude 20° [that is, in India, for in Africa I believe it is not unfrequent in the

Cape colony]. Its well known note was often heard in Goomsoor." Colonel Sykes mentions it as found, though rarely, in the Bombay Deccan; and Major Franklin designates it "the common Cuckoo of India": but I have never yet heard its note in the vicinity of Calcutta, though I possessed a living specimen for some months which was taken in the neighbourhood. It is a very rare bird, according to Dr. Horsfield, in Java, and in the specimens from that island "a very slight difference from the bird as it occurs in Europe is observed." Can it be, therefore, that the nearly allied *C. micropterus* is here mistaken for it? I possess an example of the latter from the Malay peninsula, and the Javanese *C. striatus* of M. Drapiez would seem to be no other. The *C. canorus* measures fourteen inches long, by twenty-six inches across; wing from bend eight inches and three-quarters, and tail seven inches, its outermost feathers two inches shorter; bill to forehead* (through the feathers) an inch, and to gape an inch and three-sixteenths; tarse seven-eighths of an inch.

4. *C. micropterus,* Gould, *P. Z. S.* 1837, p. 137; probably *C. striatus,* Drapiez, *Dict. Class. d'Hist. Nat.* IV., 570* (1823); *Dunmun Cuckoo, var. A., Latham, Gen. Hist.* III., 264,—that previously described by him being either a variety, or (more probably) merely an imperfectly moulted young specimen, retaining its nestling white-tipped larger wing-coverts,—erroneously (I presume) referred by this author to the *Coucou vulgaire d'Afrique* of Levaillant, or *C. gularis* figured and described in Shaw's *Zoology* (IX, 83), which would seem to be very closely allied. (GREAT-BILLED CUCKOO.) Differs from *C. canorus* in its inferior size, larger bill, the darker hue of its upper-parts, and differently coloured iris, while its note is very distinct: length of a male twelve inches and a half, by twenty-three inches

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* "Taille, douze pouces. Parties superiéures d'un brun cendré, bleuâtre; remiges brunes, frangées de blanchâtre, le deux premiéres dentelées de roussâtre; rectrices peu etagées [if we except the outermost pair, this holds good in *C. micropterus*], noirâtres, avec l'extrémité et des taches le long de la tige blanches; gorge et devant du cou d'un cendré bleuâtre, très-clair; parties inferiéures blanchâtres, rayées transversalement de noir; bec noir, roussâtre en dessous à sa base, pieds rougeâtres. De Java. On nous a communiqué sous le nom de *Cuculus dasypus*, un espéce de même taille venant également de Java, qui pourrait bien être le Coucou à ventre rayé [*striatus*] dans son jeune age; il en diffère en ce que les parties superiéures sont toutes traversées de bandes rousses, et qui la gorge et la devant du cou sont semblables au restes des parties inferiéures."

in extent; wing from bend seven inches and a half, and tail six inches, the outermost feather two inches shorter: another specimen had the tail six inches and three-quarters long: bill to forehead (through the feathers) an inch and one-eighth, and to gape an inch and five-sixteenths; tarse three-quarters of an inch. Bill coloured as in *C. canorus*, but the irides pale dusky, and the orbits and feet light wax-yellow: the abdominal cross-streaks are, also, usually broader and wider apart than in *C. canorus;* but perhaps the most ready distinction is afforded by the comparative shortness of the wings. Colour of the upper-parts darker, and in old birds uniform pure dark ashy; in specimens once moulted a bronzed ash-brown, with the head and neck grey, the throat and breast pale grey, and slight traces of rufous on the sides of the neck and on the wings. A young Malayan specimen has much white about the head, occupying the whole loral feathers, broadly margining the lateral feathers of the crown, and passing backward as an ill-defined streak to the occiput; ground-colour of the upper-parts dull brown, with a slight gloss of bronze; the nuchal feathers having one broad bar of white, which is little seen from their overlapping, and slightly edged with pale rufous; the interscapularies with a narrow single bar of pale rufous, and margined with the same; scapularies, wing-coverts, and tertiaries, more broadly tipped with dull white, and together with the primaries and secondaries more or less barred or spotted with dingy rufous; inner webs of the primaries marked with white, as in the adult; the white markings on the shafts of the tail-feathers more developed, and the medial tail-feathers spotted with faint rufous along both margins; the upper tail-coverts are barred with rufous and tipped with whitish, the lower almost spotless: under-parts fulvous-white, barred with dusky, which latter is almost hidden on the throat and breast by the broad pale margins of the feathers.*

This bird is common on the Himalaya, and I was informed by Lieut. Tickell that it is of frequent occurrence in the neighbourhood of Chyebassa, in Central India, but I cannot find it recorded in Mr. Jerdon's catalogue, though I doubt not it is occasionally met with throughout the wooded parts of the country. A specimen from the Malay peninsula has already been noticed, and I presume it to be the Javanese *C. striatus* of M. Drapiez, if not also Dr. Horsfield's Javanese slight variety of *C. canorus;* I also find it included in Mr. Vigne's catalogue of his collection of birds procured in Kashmir and Little Tibet (*Proc. Zool. Soc.*, January 26, 1841). About Calcutta it is not rare, though I have hitherto been able to procure but one recent specimen; but I have often heard the musical note of another in possession of a native, and from which is derived its Bengalee appellation of *Bocuttácko*. Lieut. Tickell termed this a double repetition of the sound *cuckoo*, and the tone of utterance is much the same as in the last species, or it may be styled a melodious deep-toned whistle, agreeable to hear despite its monotonous reiteration. Among the natives this bird is an especial favorite. The captive specimen had the same pale feet and orbits, as compared with the European species, and light dusky irides, as in that which I procured for the Museum: but neither of these were in the final pure grey plumage, but in what I have described as their second dress. The name *Dunmun*, which according to Dr. Latham this species bears in Calcutta, seems to be quite unknown here.

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* This young bird seems to agree, except in being a trifle smaller, with the *Brown Cuckoo* of Latham, *Gen. Hist.* III., 291. " Length thirteen inches, bill bent; general colour of the back and wings brown, mottled with white; head, neck, and under-parts, white, with dusky markings; tail long, cuneiform, whitish, barred irregularly with dusky, legs bluish, toes before and behind tolerably hooked. Inhabits Ceylon."

5. *C. poliocephalus*, Latham, *Gen. Hist.* III., 181,—the grey old male; *C. Himalayanus*, Vigors, *P. Z. S.* 1831, p. 172,—Gould's *Century*, pl. LIV., but the tarse erroneously represented as unfeathered;—not of Jerdon, *Madr. Jour.* XI., 220: the female, or dress corresponding to that occasional livery of *C. canorus* upon which was founded the fictitious *C. hepaticus*. (SMALL HIMALAYAN CUCKOO.) Male exactly resembling the mature examples of the last species in colour, except that the specimen examined has a stain of rufous on the breast, as often happens in younger males, and especially females, of *C. canorus*, (though the bird here described had nearly quite assumed this livery for at least the second time); but the size is very much smaller, this measuring but ten inches to ten and a quarter in length, the wing five inches and seven-eighths, or commonly a trifle less, and tail five inches and one-eighth; bill from forehead eleven-sixteenths of an inch, and from gape an inch; tarse posteriorly five-eighths of an inch. It is possible that old females assume a similar garb; and that young males, once moulted,

do not differ in their colouring from ordinary females. The latter have all the upper-parts fine rufous-bay, spotless (or nearly so) on the forehead, sides of the neck, and rump, but elegantly barred with dusky across the scapularies, wings and tail, and faintly on the crown, hind-neck, and interscapularies: under-parts barred more broadly than in the male, including the lower tail-coverts, which in the male are spotless; the throat, fore-neck, and breast, whitish along the middle, and stained with rufous laterally, having also dark bars more or less distinct; and there are the same white markings along the shafts, and at the tips of the tail-feathers, as in the male of this in common with the foregoing species, which white markings are wanting in C. *niger* and probably *Sonneratii*. A specimen in full-grown nestling plumage has the bill shorter, less curved, and wholly black; and the plumage altogether as in the darker examples (which I believe are always females) of the young of *C. canorus:* the head, neck, and smaller wing-coverts, being dusky-black, margined, as is the whole upper plumage, with white; fore-neck and breast the same, but with a white bar across the middle of each feather; a similar bar, but faint rufous, across the scapularies and interscapularies, and two or more such bars on the upper tail-coverts; tail as in the female, but having the white markings more produced, as are also the rufous bars of the primaries.

Upon a former occasion, I referred this species to C. *Sonneratii*,* but have since met with another from peninsular India which I cannot doubt is the latter, while the adult male of the present one is distinctly the C. *poliocephalus* of Latham. It appears to be peculiar to the Himalaya, and the specimens here described are from Darjeeling. I have been informed that its note is proportionally very loud.†

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* Vol. XI, p. 168.

† Here may be noticed the *C. rubeculus*, Swainson, *Nat. Libr.*, *Birds of Western Africa*, II, 181. " Wings six inches and a half long; breast and sides of the neck rufous; body beneath fulvous-white, with broad black bars; tail black, with three white spots down the shaft; the tips white. This Cuckoo is at once known from the last [*C. nigricans*, Swainson,—" Above and beneath black, glossed with blue; quills internally white, with blackish bands; tips of the lateral tail-feathers whitish; bill and legs black;"] by the colour of its tail and the greater breadth of the black bars on the body. A young specimen, in a state of moulting, has obviously been prepared by the Senegal bird-stuffers; but what we consider as the adult bird is a specimen sent, as we are informed, from India: both, however, agree in the length

Two species are confounded with it in Mr. Jerdon's elaborate catalogue of the birds of peninsular India, namely, the young of his doubtfully cited *C. flavus*, which is *C. tenuirostris* of Hardwicke and Gray, and evidently identical with *C. niger* of Latham and Gmelin, and the closely allied species which I refer to *Sonneratii*, Auctorum, both of these having been sent me by Mr. Jerdon as the adult and young of *C. Himalayanus* of his list. One of them agrees with all the preceding in having the tarse half-feathered, but the plumage of both is much more closely barred, and the tail in particular (of *C. niger* at least, for the other has this part too imperfect to judge from,) presents as many as fifteen cross-bars in the young bird, wherein this agrees with the female Cöel. There would appear to be other Indian species allied to these, which are at present very imperfectly known: and I much suspect that all will prove to have the males glossed dusky-ash of some shade, without markings except on the tail, while the females are permanently barred or spotted, in which respect they would resemble the Cöels (subgenus *Eudynamys.*)

6. *C. Sonneratii* Latham, *Ind. Orn.* II, 215; *le petit Coucou des Indes* Sonnerat, *Voy. Ind.* IV, 216; *C. Himalayanus* apud Jerdon, *Madr. Journ.* XI, 220, where *C. tenuirostris*, Hardwicke and Gray, is introduced as a synonym, the young of this being con-

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of the wings and the peculiar colour and markings of the tail, so that we have but little doubt that they are of one species; although, in the young bird, the rufous colour of the breast, and the bands on the body, are not so dark as in the supposed adult from India. The vent and under-tail-coverts are light buff-colour."

It may be remarked that Mr. Swainson is one of those authors who, in general, use the term *India* in the vaguest signification, including the Burmese and Malay countries, if not all Southern Asia eastward of the Indus. Thus, to select one of many instances, he remarks, of the *Eurylaimi*, that "their geographic limits seem to be restricted to the hottest parts of India" (*Class. Birds*, II, 86); the truth being, that no species has yet been discovered in the "hottest parts of India," properly so called, but there are two on the flanks of the Himalaya, a third in Assam, and proceeding thence southward, to the east of the Bay of Bengal, the number increases in the ceded Tenasserim provinces, and attains its maximum in the Malay Peninsula and Islands; the two species first alluded to, however, not extending southward, so far as has yet been observed. Consequently, one of the distinctive features of the Ornithology of India, on the one hand, and of the Burmese and Malay countries on the other, consists in the developement of this remarkable group in the latter; and the impropriety of designating the whole by the appellation *India*, is especially apparent in the case cited.

founded with the present species. (SONNERAT'S? CUCKOO.) The only objection I can perceive to the propriety of referring a specimen before me to the *Little Indian Cuckoo* of Sonnerat, is that, that author states the bill, feet, and irides of his bird to be yellow, whereas in the one here described the feet appear to have been dusky-plumbeous, with at most a tinge of yellow, and the bill is wholly black, mixed with whitish on the lower mandible. It resembles so much the female and young of the next species as to have been confounded with them by so acute a discriminator as Mr. Jerdon; but may, nevertheless, be readily distinguished from them by having the tarse half-feathered, and by the greater length and stoutness of the bill, which is also less compressed towards the tip. Probable length of the recent specimen about nine inches and a half, of wing five inches and one-eighth, and tail (the medial feathers being wanting) four inches and one-eighth; bill to forehead (through the feathers) above an inch, and to gape an inch and one-eighth; tarse three-quarters of an inch, and externally feathered nearly to the toes. Another distinction from the females and young of the next species consists in the whole under-parts from the throat, being white, but very faintly tinged with fulvous on the flanks, and marked throughout with numerous narrow dusky bars, agreeing thus with the description given by M. Sonnerat; the sides of the head and neck are also white similarly barred, but the ear-coverts are coloured like the back, and the frontal feathers white at base, shewing conspicuously just over the bill; upper-parts uniformly greenish-dusky, with numerous cross-bars of rufous, excepting on the coverts of the primaries, while the latter have only an indication of these bars on the extreme edge of their outer-webs. Of the tail only two feathers exist in the specimen, which appear to belong respectively to the second and third pair; their colour is rufous, with a broad dusky bar near the end, the external webs almost wholly dusky, with traces of rufous barring on the extreme edge, more conspicuous towards the base, and fragments of numerous other bars on the inner web; its two external feathers are also seen, on turning up the rump plumage, to be growing, and what appears of them is rufous with a whitish tip, a dusky outer web and subterminal broad bar, with other narrower bars on the inner web. The body-plumage had recently been renewed, and I judge the specimen to be a mature female, and have very little doubt that the adult male will prove to resemble much that of the next species.

Mr. Jerdon states of this bird, though it is necessary to bear in mind that he did not properly distinguish it from the following species, that "it is found, though rarely, all over the peninsula, in thick forest jungle. I have observed it once or twice only, in Malabar, and in the Coonoor Ghaut, but have seen specimens from Travancore, where it appears tolerably abundant, and also from the eastern range of ghauts, about the latitude of Madras. The stomach of the only specimen I shot contained caterpillars."

7. *C. niger*, Latham, *Gen. Hist.* III. 285*; *C. Bengalensis niger*, Brisson, IV. 141,—as cited by Latham; *C. tenuirostris*, Hardwicke and Gray,—the middle-aged female; doubtfully quoted as *C. flavus, honoratus, Sonneratii*, and *lugubris*, by Mr. Jerdon, *Madr. Journ.* XI. 220, but distinct from all of these,—the adult male. (PLAINTIVE CUCKOO.) Distinguished from the preceding by its smaller, shorter, and more curved bill, and wholly naked tarse. Length, of a male, nine inches, by thirteen inches in extent; wing four inches and a half, and tail the same, its outermost feathers an inch shorter; bill to forehead (through the feathers) barely seven-eighths of an inch, and to gape fifteen-sixteenths of an inch; tarse somewhat exceeding five-eighths of an inch. Plumage varying much in colouring according to age and sex. What I infer to be the fully mature male is described by Mr. Jerdon to have "the plumage above entirely cinereous, with a slight indication of greenish gloss on the wings only; beneath pale cinereous, vent and under tail-coverts white; the quills with a broad white band on the internal webs; and tail black, its inner webs banded with white, except the two central feathers, and all tipped white. Irides of a fine ruby red." Another is described by him to be "entirely of a dark cinereous tint, with a strong gloss of green throughout; tail blackish, edged with rufous; quills beneath cinereous. Irides blood-red: the bill blackish red beneath (at the base), also at the gape and internally; feet reddish." A third he describes as of "the same glossy green colour above, with the exception of the rump, which is a lighter cinereous without any green,

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* The sole objection to this identification is, that the bill is stated to be orange.

and the forehead—which also is nearly devoid of the green; chin and throat cinereous; breast the same but darker, banded with rufous and white; the belly pale cinereous, faintly marked with pale rufous and white; under tail-coverts and tail as in the first." One procured near Calcutta, from which the admeasurements here given were taken, agrees nearly with the last, and exactly with a specimen sent by Mr. Jerdon: irides brownish-red, the orbits dusky; bill also dusky, with merely a dull yellowish tinge at the base of the lower mandible; inside of the mouth carneous deeply tinged with coral; feet olivaceous, tinged with yellow underneath. Upper-parts wholly dusky-cinereous, with a greenish gloss, except on the head and rump; throat, breast and belly, somewhat lighter cinereous; the vent, under tail-coverts, and greater part of the exterior webs of the outermost upper tail-coverts, white; tail blackish, its outer feathers successively more broadly tipped with white, and the inner webs of the two outermost feathers on each side barred with the same. A specimen casting off the nestling livery has the new growing feathers of its under-parts a dull ruddy-brown colour without markings, including the belly and under tail-coverts, while those of the head and back are greenish-glossed dusky-cinereous, as in the last preceding adults. The gloss of the upper-parts of this young bird, as also the colour of the irides of the glossed Bengal specimen before described, together with the analogy of *C. micropterus*, (the second brownish plumage of which is much bronzed, while little or no trace of this exists in dark ash-coloured specimens,) indicates that the glossless uniform dark ashy examples of the present species are also in fully mature plumage, the glossed being younger birds. A specimen, which I infer to be an old female, agrees in dimensions: all the upper-parts are bright rufous, barred with broader dusky bands than in younger birds, having a greenish shine, and which are obsolete on the occiput and rump, and nearly so on the upper tail-coverts; primaries wholly dusky-brown, with slight rufous edges towards their base only, these being more developed on the secondaries; tail rufous, its medial feathers marked along the shaft with dusky, and the rest shewing fragments of dark bars, and a broader subterminal dusky band, with a white spot at the tip; sides of the neck rufous, the throat, fore-neck, and breast, much stained with the same, and more or less crossed with undulating dusky bars; belly, flanks, and under tail-coverts, white, with similar cross-bars more scanty on the last; some of the tibial feathers shewing traces of rufous, but otherwise white barred with dusky: the legs appear to have been dusky-yellowish. Two other presumed females agree better with General Hardwicke's figure, except that their colouring is not so rufous, but more ferruginous, and their markings generally somewhat finer: both have the entire under-parts deeply tinged with dingy ferruginous, a little albescent on the belly and lower tail-coverts; their upper tail-coverts and rump have very numerous cross-bands, as likewise the occiput; and the tail has as many as fifteen bars, the same as in the female Coël. The immature plumage of the young male before noticed, as killed while in moult, has the barring of the upper-parts of a more mottled character, the ferruginous tint paler, and the nestling feathers retained on the under-parts are banded pretty much as in the last described females; its new tail-feathers resemble those of the adult male, while the only one left of the nestling series (being the penultimate) is rufous, crossed with twelve or thirteen dusky bars.

The points of resemblance between this bird and the common large Coël (*Eudynamys orientalis*) are worthy of being noticed; viz. 1. the crimson irides,—2. the sexual diversity of plumage, which I suspect to be constant,—3. the uniform dark colouring of the male,—and 4. the nakedness of the tarse, wherein it differs from all the foregoing species; while the number of caudal bars in, at least the younger females is a further token of this affinity, and *C. honoratus* would seem to be intermediate. Latham's description of his male *C. niger* is sufficiently accurate, except that he assigns an orange colour to the bill; but his female does not accord with any specimen which I have seen. This is described by him as having "a pale bill; is brown above, spotted with white; head striped white and brown, over the eye a white streak; under-parts white, with irregular brown spots; thigh-feathers long, barred with brown; tail cuneiform, brown, *crossed with fourteen or fifteen* whitish bars, the tip fringed with white; legs pale blue."

From what I can learn, this Cuckoo appears to be not a rare bird in Bengal, though I have hitherto succeeded in procuring but one recent specimen[*]; and Mr. Jerdon remarks that "the Plaintive Cuckoo, as it may be appropriately named, is an inhabitant of the western coast of the peninsula, being found alike in thick jungle, and in the more open spaces, and even in gardens and avenues. It occurs at all levels from that of the sea, to the top of the Neilghierries, about Coonoor and Kotagherry, where it is found in thick bushy ground. [I have been informed by this naturalist, that he has since ascertained it to be much more generally diffused than he formerly supposed.] Like the other Cuckoos it is found single or in pairs. It has a most sweet and plaintive note, which is often heard, and which sounds something like the last syllable, being *whe-whew, whe-whe-ē-w*; much lengthened out, and very plaintive. I found its food to consist chiefly of caterpillars."[†]

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[*] I have since obtained others, among which is a female that had nearly acquired the adult garb of its sex, similar to that described above,—also two males, quite similar to each other, but in a phase of plumage different from any described in the text, and one of them incompletely moulted into this livery, retaining a few unshed secondaries and wing-coverts, together with some scattered feathers upon the nape, belonging to the first or mottled dress common to both sexes. These have the back and wings dark grey, glossed with green, the head, neck, rump, throat, and breast, pure ashy, the last being tinged with rufous, while the rest of the lower-parts, from the shoulders of the wings to the lower tail-coverts inclusive, with also the fore-part of the inner surface of the wings, and the axillaries, are uniform bright rufous-buff; irides comparatively dull red. A specimen described in the text was also moulting out of its first or mottled livery, and throwing out rufous feathers on the under-parts, but these are considerably duller than in the two now noticed, and they equally appear on the throat and breast, which in the present specimens are grey; moreover the upper-parts were coming much darker than in the latter, and equally so on the crown and back. The man who shot one of the rufous-breasted males here described, informed me that he saw it follow a butterfly on the wing, which it endeavoured to capture with its feet in the manner of a Hawk; a trial that has already been recorded of the European Cuckoo. I may add that the average size of the present species exceeds the dimensions given in the text, the males commonly measuring about nine inches and a half long, by thirteen inches and a half across; and the females nine quarter by twelve inches and three quarters.

[†] The Javanese *C. rufovittatus* and *C. pyrogaster* (habitat not given) of Drapiez (*Dict. Class. d'Hist. Nat.*, Art. *Coucou*), may be varieties of this or the preceding species.

"*C. rufovittatus.* Taille, sept pouces. Parties superiéures d'un brun noirâtre, rayées de roux vif; plumes du front blanches à leur base; rémiges brunes, dentelées de roux à leur bords; rectrices largement bordées de roux, avec l'extrémité blanche, d'un roux fauve en dessous; gorge, devant et côtes du cou, et poitrine blancs, finement rayés de noirâtre; parties inferiéures d'un blanc roussâtre; bec noir, brun en dessous à sa base; pieds d'un jaune rougeâtre. La femelle a fauve tout ce qui est d'un roux

8. *C. flavus*, Gmelin: *le petit Coucou de l'Isle Panay*, Sonnerat, *Voyage a la Nouvelle Guinée*, p. 122; *le petit Coucou à tête grise, et ventre jaune*, Buffon, *Hist. Nat.*, *Ois.* VI, 382. So far as an opinion can be formed from Sonnerat's figure of this species, I incline to regard it as nearly allied to the preceding one; but the tarsi are doubtless represented much too long, and they are figured to be naked, as in *C. niger*. Length (apud Buffon) about nine inches, of which the tail measures more than half, and is of a wedge shape. Upper part of the head and throat light grey; the nape, back and wings, pale umbre-brown; belly, thighs, and lower tail-coverts, pale yellow tinged with russet; and the tail black, barred with white. Bill and feet light yellow, the former tipped with black. A female is described by Sir Stamford Raffles to have "the tail barred with brownish-yellow instead of white, and the grey extending to the breast. ' The nostrils are perfectly round and tubular, their edge forming a prominent ring. Found at Pulo Penang:" also in the island of Panay, and very abundant in Java, and doubtless in the Malay countries generally; frequenting the plains and cultivated tracts, where, in Java (according to Dr. Horsfield), "it is heard in the morning from almost every tall tree. It has three distinct notes, which it repeats in great regularity with a loud but not unpleasant voice, although by many natives it is considered ominous of evil."

9. *C. (Eudynamys ?) honoratus*, Lin; *Cuil*, v. *Coucou tachété de Malabar*, Buffon, and figured in Shaw's *Zoology*, IX, 104: identified, according to Levaillant, with his African *Coucou Tachirou, Oiseaux d'Afrique*, pl. 216, apud *Dict. Class. d'Hist. Nat.*, IV, 569. This manifestly appertains to the Coël section, differing from the common Coël in being much smaller, in having a still more graduated tail, &c.: what is probably the livery of the female and young appears to be the only one described in the books to which I have access.

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vif chez le mâle; elle a le sommet de la tête cendré, la gorge et les côtés du cou teints de fauve, et toutes les parties inferiéures rayées de noirâtre. De Java.

" *C. pyrogaster*, Vieillot. Taille huit pouces, six lignes. Parties superiéures d'un brun bronzé, rayées transversalement de fauve; sommet de la tête tirant sur le cendré; rémiges intermédiares dentelées de fauve, les latérales de blanc; toutes étagées et terminées de blanc; gorge, dessous du cou, poitrine et ventre d'un fauve pâle, rayés transversalement de brun et de blanc; bec noir, brunâtre à sa base en dessous; pieds rougeâtres."

Length above a foot, the tail about six inches, and very much graduated, its outermost feathers scarcely more than half the length of the middle ones. All the upper-parts blackish-ash, marked with two points of white on each feather; the throat and under-parts white, with ash-coloured cross-rays; quills cinereous, and also marked with transverse macular bars. This bird is stated to inhabit Malabar, but much requires to be verified as an inhabitant of India. It is apparently intermediate to the common large Coël and diminutive *C. niger*.

10. *C. (Eudinamys,* Vigors and Horsfield, *Lin. Trans.* XV, 304,*) orientalis,* Lin.; *C. Indicus,* Latham, *Ind. Orn.* III, 285; and the female—*C. Mindanensis, scolopaceus, crassirostris, punctatus,* and *maculatus,* Auctorum. (COMMON COËL.) Length fifteen and a half to sixteen inches, by twenty-three inches in extent; wing seven inches and a half, and tail the same; bill an inch and a quarter to forehead (through the feathers), and nearly one and a half to gape; the tips of the mandibles opening to two inches and a quarter from the hooked extremity of the upper one; tarse an inch one-eighth, and bare of feathers except close to the joint: irides bright crimson, affording a very conspicuous character in the living bird, and quite relieving the sombre uniform greenish-glossed black colour of the plumage of the mature male: bill pale greenish, and inside of the mouth flesh-coloured: legs somewhat bluish-slaty, or in younger individuals dull greenish lead-colour. Average size of both sexes alike, or nearly so, though it may be that the females are more commonly somewhat the larger. Too well known in India to require a further description. This bird is very common in Bengal, as also in the Malay countries, extending even to Australia *(Lin. Trans.* XV, 304), where, however, it is understood to be rare.* Mr. Jerdon notices it as "common in the Carnatic in groves, gardens and avenues, and also on the west coast; but rare on the bare table-land. It feeds entirely on fruit, and is remarkably fond of the fig of the banyan tree." During the time these figs are ripe, which is early in the cold season in Bengal, the trees are quite alive with Barbets *(Bucco),* Coëls, and other less abundant visitants. Col. Sykes remarks, of the Coël, that "its sin-

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* The *Cuc. crassirostris,* currently identified with this species, is described as African.

gularly loud notes are not at all like those of a Cuckoo" (*P. Z. S.* 1832, 97): assuredly they do not resemble that "note of fear, unpleasing" to particular parties. but those who are acquainted with the melodious liquid shaking note which the European Cuckoo frequently utters as it takes wing, will immediately recognise the Coël's cry as thoroughly *cuculine;* at least I did so, before I knew what bird it proceeded from. The Coel is very commonly kept caged by the native inhabitants of Calcutta, becoming quite fearless and familiar, and frequently uttering its loud cry (*koyo-koyo-koyo,* with variations,) adverted to by Col. Sykes, as well as another note, which truly corresponds to the sound *cuckoo* emitted by the bird of Europe, and which sounds like *ho-whee-yo*, delivered at intervals as the *C. canorus* utters its well-known cry, often for a long while together, and not unfrequently in moonlight nights. The Coel is remarked by Mr. Jerdon to be parasitic,* and here as with him usually selects the nest of the common Indian Crow (*Corvus splendens*) to deposit its egg (or, as I am told, generally two eggs) in; and I am further assured, that it is no unfrequent occurrence for the Crow to turn out the young Coël at the age when it has begun to put forth its spotted feathers. This remains to be certified by further observation. The Coël is very good eating; and the same is stated of the European Cuckoo. As compared with the allied species, its robustness of form would seem to be exceptional, rather than normally characteristic of its sub-genus, and its relation to some of them may be compared to that of *Gracula* (or *Eulabes*, Cuv.,) *religiosa* to *Pastor tristis* and the other thick-built smaller Mynahs.

I shall not venture to introduce, as an established species, different from the Coël, the *C. Panayus*, Latham, *Ind. Orn.* I., 210, *Gen. Hist.*, III., 281,—founded on the *Coucou tacheté de Panay* of Sonnerat: which appears to differ only from the female *orientalis* in wanting the rufous on the ear-coverts (not always present in the young of the latter), and in having an ungraduated tail: the throat and upper part of the front of the neck are also figured and described as black, spotted like the back, and abruptly defined. It is said to inhabit the island of Panay, but needs verification.

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* Vide also *J. A. S.* VIII 684.

Subgenus *Pseudornis*, Hodgson, *J. A. S.* VIII. 136.* (DRONGO CUCKOOS.) Essential structure that of the other Cuckoos with feathered tarsi, but the tail even or forked, except that the outermost feathers are much shorter than the rest, and the two lateral halves of the tail curve outwards towards the extremity, as in the Drongos. The size, colouring, and general aspect, also, so closely resemble those of the Drongos (*Edolius*, subgenus *Dicrurus*), that an ordinary observer might readily mistake one for the other, whence Mr. Hodgson's apt designation of *false bird* (*Pseudornis*), i. e. 'disguised Cuckoo.' Mr. Jerdon, indeed, suggests, of one of them,—"Does this Drongo Cuckoo select the nest of the *Dicrurus* to deposit its eggs in? If so, the foster-parents would hardly be undeceived even when their progeny were arrived at maturity." The sexes are similar, but whether the young also resemble the adults I am unaware. These birds inhabit upland forests.

11. *C.* (*Pseudornis*) *dicruroides*, Hodgson, *J. A. S.* VIII. 136—*Madr. Journ.* XI., 221. (FORK-TAILED DRONGO CUCKOO.) Length ten inches to ten and a half, of wing five and a quarter to five and a half inches, and of penultimate tail-feathers five inches and a half to five and three-quarters, the outermost an inch and a quarter less, and the medial three-eighths of to half an inch less than the penultimate; bill to forehead (through the feathers) an inch, and to gape rather more; tarse three-quarters of an inch. Irides hoary-brown; bill black, the palate red; legs and feet blue. Colour black, with a changeable blue and green gloss, brighter on the upper-parts: head subcrested: the outer webs of some of the long tibial feathers white, as also those on the tarse, and the under tibial feathers which are of downy texture; a minute speck of this also near the tips of the outer principal wing-coverts, but often obsolete; the same occasionally on the tips of the upper tail-coverts, and a series of such on the lower tail-coverts; the outermost tail-feather obliquely barred with white, the bars in some contracted into spots, and finally an oblique streak of white on the inner surface of the wing, and a round spot of it on the inner web of the short outermost primary.

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* Erroneously identified with *Oxylophus*, Swainson, by Mr. G. R. Gray, *List of the Genera of Birds, &c.* 1st edit. p. 57.

In Nepâl, according to Mr. Hodgson, this species is confined exclusively to the mountain forests; and I am informed that it occurs rarely at Darjeeling. A single specimen has been obtained by Mr. Jerdon in Southern India, near Manantoddy, in the Wynaad; in this individual the irides are stated by him to have been reddish-brown, and the legs reddish.

12. *C. (Pseudornis) lugubris*, Horsfield, *Lin. Trans.* XIII. 179, and *Jav. Res.*, with a coloured figure; *C. albopunctulatus*, Drapiez, *Dict. Class. d'Hist. Nat.* IV, 570. (SQUARE-TAILED DRONGO CUCKOO.) This so very much resembles the last as to require some consideration as to the propriety of admitting them as distinct; but on minute comparison I am satisfied that they are distinct, although the plumage absolutely resembles, to every white speck and marking on the greenish-glossed black ground; the example of *C. lugubris* before me has, however, an occipital spot composed of three or four wholly white feathers, which I do not perceive in the preceding species, though both specimens of the latter which I have for comparison are unfortunately somewhat defective of feathers just at that part; there are also a few scattered white specks upon the crown and on the breast of *C. lugubris*, which however may occur in some specimens of the other: the more distinctive differences consist in the present being a smaller bird, with shorter wings and tail, the latter square, or merely exhibiting a furcate tendency from the decided curvature outward of each lateral half, besides which the outermost pair of tail-feathers are in a greater degree shorter than the rest than in *C. dicruroides*. Length about nine inches, of wing four inches and seven-eighths, and tail four inches and a half, its outermost feathers an inch and a half shorter than the rest, whereas in *C. dicruroides* these are but an inch and a quarter shorter than the more elongated penultimate tail-feathers; bill to forehead (through the feathers) fifteen-sixteenths of an inch, and to gape an inch; tarse under five-eighths of an inch. Bill and feet black, according to Dr. Horsfield, but the latter seem to have had a yellowish tinge in the Society's specimen: irides, according to the same authority, dark-coloured.

"The *C. lugubris*," writes Dr. Horsfield, "is found in districts of secondary elevation, which are diversified with extended ranges of hills and covered with luxuriant forests. The southern and western parts of Java are generally of this description. In the extensive central plains intervening between abrupt, conical, and elevated mountains, and which are generally in a high state of culture and covered with flourishing towns and villages, I have rarely observed it. This bird retires into the deepest coverts, and having a dark plumage, it is with difficulty surprised. Its peculiarities, both as to voice and habits, have not, as far as known to me, been observed. Its habits are very different from those of *C. (Eudynamys) orientalis* and the *C. flavus,* both of which are very abundant in Java." The specimen here described was brought from Singapore.

Subgenus *Chrysococcyx,* Boié (1826), v. *Lampromorpha,* Vigors, v. *Chalcites,* Swainson. (METALLINE CUCKOOS.) The members of this group absolutely resemble the first or typical Cuckoos in structure, being merely characterized, in addition to their very small size, by the resplendent metallic hues of their plumage.

At least three inhabit the Malay countries, two of which are described by Dr. Horsfield in *Lin. Trans.* XIII. 179, and one of them more elaborately in his 'Zoological Researches in Java'; besides which the next appears to be not uncommon in the Malay peninsula, if not also in the Tenasserim provinces.

13. *C. lucidus,* Gmelin; *C. Malayanus,* Raffles, *Lin. Trans.* XIII. 286,—the female; C. *metallicus,* Vigors, *Ibid.* XV. 303,—the young, as satisfactorily shewn by specimens in transitional plumage. (BANDED EMERALD CUCKOO.) What are evidently the male, female, and young, of a species which appears to be referrable to the foregoing, are clearly identical with one another, the intervention of the female livery assisting to demonstrate the necessity of bringing the above synonyms together. Length of a splendid male fully seven inches, of wing four inches and a quarter, and tail three inches, its outermost feathers half an inch shorter; of bill to forehead (through the feathers) five-eighths of an inch, and tarse half an inch. Bill, in the dry specimen, translucent pale straw-yellow, both mandibles tipped with dusky. All the upper-parts, with the breast, brilliant dark emerald-green, the feathers silky in texture, and having a rich and slightly aureous silken gloss; belly, sides, and under tail-coverts, with the inside of the wings anteriorly, white, transversely barred with shining green; tail like the back, a pair of unmoulted old feathers, next to the uropy-

gials or central pair, of a duller or more bronzed green, with dusky tip and slight rufous edge, and one of the outermost pair, also unmoulted, having a pale tip and deep rufous barrings, but the corresponding outermost feather on the other side, which has been moulted, having smaller bars of white, almost confined to the outer web; rest of the tail streakless, and equally bright on both webs as the uropygials, the penultimate feather only being slightly tipped with white; such of the large wing-feathers, also, as have been renewed, are bright-green like those of the back, the old being dusky with merely a faint gloss of green, and the old coverts a more bronzed green, slightly tipped with rufous. A presumed old female is smaller, or barely six inches and a half long; wing from bend four inches and one-eighth, and tail two inches and three-quarters: dusky tips of the mandibles rather more developed than in the male: this specimen also is moulting, and the new feathers of its wings and tail resemble those of the other sex; but the rest of the upper-parts are much more bronzed, especially on the head and neck, and the feathers of the crown have each a well defined narrow whitish bar; throat, front of neck, and breast, also bronzed shining green, with white cross-bars; and rest of the under-parts resembling those of the male, but the transverse green markings more bronzed. Three specimens of the young differ from the young of the subgenerically restricted Cuckoos in having no transverse bars on the upper parts: crown, nape, and interscapularies, a rather faintly bronzed dull-brown, the last also more or less of a shining green, which prevails on the scapularies, tertiaries, and on the wing and tail-coverts; under-parts whitish, barred throughout with faintly bronzed brown; primaries and secondaries, with the coverts of the former, and the winglet, dull brown, the primaries marked at the basal half of their inner webs underneath with white, as is also the case in the adults; tail brown, with a faint green gloss and subterminal dusky band, all but the uropygials having a white spot at the tip of their inner webs, and the outermost feathers having both webs barred with white, and more of this than in the adult, and the rest with two or three rufescent bars on the inner web only: bill wholly dusky.

The *C. lucidus* was originally discovered in New Zealand, and is also known as an inhabitant of Australia, from which continent the specimen described as *C. metallicus* was obtained. The *C. Malayanus* of Sir Stamford Raffles, is mentioned as a "native of the Malay peninsula"; and the specimens here described are from that country and (I believe) Tenasserim.

14. *C. chalcites*, Temminck, *Pl. Col.* CII, fig. 2; *C. basalis*, Horsfield, *Lin. Trans.* XIII., 179. I copy the following description from Shaw's Zoology, XIV., 209. "Length rather more than five inches and half [six inches, Horsfield], the male having the top of the head red, with a bronzed gloss; the back and wings plain metallic green, the tail above red at its base, a little shaded with green in the middle, and white at its tips, the two lateral feathers having large oval white spots on their inner webs: the fore-part of the neck and the breast are whitish, varied with brown; the belly is white; the under tail-coverts whitish spotted with bronzed green; the tarse long and naked [?]. The female is reddish above, very slightly shaded with bronze, and white beneath."

From analogy I should judge that the female and young, rather than the mature male and female, are here described. This species) inhabits Java and Australia. The identity of C. *basalis* and *C. chalcites* is stated by Dr. Horsfield in the 'General Catalogue of Javanese Birds,' prefixed to his Zoological Researches in Java, where also we are informed that *C. pravata*, Horsf., briefly described in *Lin. Trans.* XIII., 179, is "to be cancelled."

15. *C. xanthorhynchos*, Horsfield, *Lin. Trans.* XIII, 179,—*Jav. Res.*, with a coloured figure. (Amethystine Cuckoo.) Length six inches and half, of wing four inches, and tail three inches, its outermost feather half an inch shorter; bill to forehead (through the feathers eleven-sixteenths of an inch, and tarse half an inch. Colour of the upper-parts and breast brilliant amethystine-violet, with dull dark margins to the body-feathers slightly glossed with green; beneath white, barred across with dark green; outermost caudal feathers having five white bars, the last terminal, and the two basal not extending to the inner web; the next two feathers on each side are tipped with white, and the penultimate have rudiments of other white bars; rest of the same splendid colour as the back: bill wholly yellow, and much less thick than represented in Dr. Horsfield's plate; and feet apparently dusky: the crown is very slightly crested. Inhabits Java, where stated to be rare and very shy. Dr. Helfer mentions its existence, also, in the

Tenasserim provinces, and it is probable that the *Asiatic* Society's specimen was thence obtained.

Subgenus *Oxylophus,* Swainson. (Crested Cuckoos.) These have bare tarsi, and the occipital feathers lengthened to form a considerable crest: the wings shorter and less pointed than in the preceding, having the fourth primary (instead of the third) more or less the longest: they are never barred or mottled at any age; and are mostly green-glossed black above, and whitish beneath, sometimes varied with other colours. I know of nothing peculiar in their habits.

16. C. *Coromandus,* Auctorum. I can hardly reconcile the conflicting descriptions of this species without some suspicion that two have been confounded under the name. That with which I am acquainted, as occurring in Bengal, Nepâl, Tenasserim, and which is also the *C. Coromandus* of Mr. Jerdon's list (*Madr. Journ.* XI, 222), is well described by Latham, *Gen. Hist.* III, 292, and may be distinctively termed the Red-winged Crested Cuckoo. A male I procured measured fourteen inches and a half long, by eighteen inches and a half in spread of wing; the latter from bend six inches and three-eighths, and middle tail-feathers eight inches and a half, the outermost four inches and a half shorter; but the tail is generally somewhat longer than this, its middle feathers not uncommonly measuring ten inches and a half; bill to forehead (through the feathers) an inch one-eighth, and to gape an inch and a quarter; tarse an inch, being a little feathered towards the knee. Irides dark hazel: orbits dusky; bill black; the inside of the mouth dull coral-red; feet lead-coloured. Upper-parts, comprising the scapularies and tertiaries, with the tail, black glossed with green, paler on the tertiaries, and less glossed on the head; the longest occipital feathers exceeding an inch and a half: a conspicuous half collar of white encircles the nape: wings invariably deep ferruginous, the tips of the primaries and secondaries dusky: under-parts white, a little tinged with fulvous, excepting the lower tail-coverts which are green-black, and the throat and fore-neck, which in some are deep ochreous-fulvous, in others (probably females) a very light fulvous, deepening laterally. The wings of the presumed females are scarcely less deep in colour than in the males.

Dr. Latham remarks, that "the above is found not only on the coast of Coromandel, but also [illegible] the south coast of Africa, where

M. Levaillant met with it, near the rivers Swarte-kop and Sondag. Many also have been brought from Senegal." In the vicinity of Calcutta it is certainly rare, as the specimen above noticed was the only recent one ever seen by the Society's taxidermists, who were unaware of its existence in this part; and it does not appear to be commoner in peninsular India, but on the eastern side of the Bay of Bengal it is more numerous, as likewise, I have reason to suspect, in Nepâl. With its note I am wholly unacquainted.

The definition by Linnæus of *C. Coromandus* is merely "*caudâ cuneiformi, corpore nigro, subtus albô, torque candidô*; saying nothing of the very conspicuous character of the rufous wings, nor of the hardly less conspicuous fulvous throat of especially the male: various other authors assign a small, round, grey spot on each side of the head behind the eye, no trace of which is perceptible in six specimens before me; and likewise assert, that the throat as well as the thighs are blackish, the latter only being more or less dusky in the specimens I have seen. Analogy with *C. edolius* renders it probable, however, that the young are here adverted to.

The *Ceylon Cuckoo* of Latham (*Gen. Hist.* III, 291,) must be nearly allied. Length seventeen inches. Bill curved, black; general colour above, and of the tail, fine blue black; the head much crested; chin and throat dull yellow-ochre; from this the rest of the under-parts are white; thighs pale ash-colour; tail cuneiform, blue-black; its two middle feathers nine inches long, the others gradually much shorter; legs blue, the hind claws curved, neither of them straight nor subulated. Inhabits Ceylon. Mr. S. Daniell."

17. *C. edolius*, Cuvier; *C. ater* and *melanoleucos*, Gmelin,—*serratus*, Sparrman; *le Coucou Edolio*, Levaillant; *Le Jacobin huppé de Coromandel*, Buffon. (Pied Crested Cuckoo.) Length thirteen inches, by seventeen inches and a half in extent of wings; the latter from bend five inches and three-quarters; and middle tail-feathers seven inches, the outermost three inches less: bill to forehead (through the feathers) an inch and one-eighth, and to gape a trifle more; tarse fifteen-sixteenths of an inch. Irides dark-coloured; bill black; and legs bluish-leaden. Colour of the upper-parts uniform black, not very intense, with a greenish shine, except the bases of the primaries which are pure white, forming a conspicuous wing-spot: all the tail-feathers,

except the middle pair, rather largely tipped with dull white: crest-feathers an inch in length: under-parts dull white, or faintly tinged with fulvescent, more especially in the female, which presents no other difference of plumage from the male. A full-grown young bird measured twelve inches and a half long, by sixteen inches and a half across: upper mandible of the bill dusky, with a slight yellowish tinge; the sides of its base, and nearly all the lower mandible, bright-yellow: irides dark hazel, with greenish-yellow orbits: feet greenish lead-colour. Upper plumage as in the adult, but much less deeply coloured, and the coronal feathers scarcely elongated, and rounded like the dorsal plumage at their tips; the throat ashy, passing downward on each side, and separated by a whitish streak from the dark ear-coverts; the rest of the under-parts, and tips of the tail-feathers, rather deeply tinged with fulvous, as also the greater portion of the wing-spot; coverts of the primaries slightly tipped with fulvous-white.

This is a common Bengalee species, and appears to be found also in South Africa, where, however, it must not be confounded with the *Oxylophus Levaillantii* of Swainson's 'Illustrations' (2nd series, Vol. I, pl. XIII), the *Varieté de Coucou Edolio* of Levaillant, or *C. Afer* of Leach and Shaw, which is nearly allied, but larger, and at once distinguished by the sagittal black spots on its throat and fore-neck. The present species was strangely referred to *Leptosomus Afer* by Major Franklin and Colonel Sykes; and Mr. Jerdon remarks of it— "The *Popeya* is distributed all over India, but cannot be said to be a common bird anywhere [here, in Bengal, it certainly is tolerably common]. It is of course most numerous in the more wooded districts. I have seen it in the Carnatic, Malabar Coast, and even on the bare Deccan, in low jungle or among gardens. It hunts single or in pairs, and feeds chiefly on various soft insects, &c. On the Neilgherries, I have seen it occasionally about the edges of the hills, frequenting the thick bushy ground there." From what I have observed of this species, it is not one which much affects concealment, but frequently sits exposed on a dead or bare branch. I have never heard from it any note resembling the sound *Popeya*, which is here also the common name of the species; but only a continuously reiterated simple cry, by no means loud. It is also designated *Koloo Bulbul*, allusive probably to its crest; for native classification is not better than popular classification in England, where the *Accentor modularis,* for example, is styled 'Hedge *Sparrow.*' Dr. Latham informs us, that it is said to lay its eggs in the nest of the Chattoreah *(Malacocercus Chataræa),* and that they are plain greenish in colour; the Cuckoo said generally to destroy those of the Thrush, when it deposits its own": this at least is true of the European Cuckoo *(C. canorus),* whence any eggs that may be found in the same nest with the Cuckoo's egg, have been laid subsequently to the introduction of the latter. The *C. Vaillantii* before noticed, according to Latham, inhabits India, a figure of it being among the drawings of Gen. Hardwicke; but I greatly suspect there must be some mistake in this.

In the Pied Crested Cuckoo, it may be remarked that the third primary is very nearly equal to the fourth, and exceeds the fifth; whereas in the Red-winged species *(Coromandus),* the third is considerably shorter than the fifth. With the Crested Cuckoos terminates the genus *Cuculus,* in its most extended signification, agreeable to modern notions of arrangement; and I next pass to the consideration of the Malkohas *(Phœnicophæus),* an extensive group generally characterized by having a somewhat large, green-coloured bill, having the nostrils basal, and placed near the edge of the upper mandible,—a coloured bare space round the eye, more or less developed,—distinct eye-lashes, in general, but rudimental only in the subgenus *Rhinortha,*—a longer tarse than in the Cuckoos, but the toes similarly formed for arboreal habits,—short and rounded wings, of which the sixth primary is usually longest, the fifth, sixth, and seventh being nearly equal—and a broad and much graduated tail, sometimes of great length.

Among them, the most distinct subgenus is that of

Rhinortha, Vigors, (1830), v. *Anadænus,* Swainson, (1837): STRAIGHT-BILLED MALKOHAS:—wherein the clothing plumage has disunited webs, and the bill is straight, tapering regularly to the end, where the tip of the upper mandible curves somewhat abruptly to overhang that of the lower one. The size of these birds is inferior to that of most of the others; and I am not aware that any occur to the westward of the Bay of Bengal.

18. *Rh. rufescens (?); Anadænus rufescens (?),* Swainson, mentioned in *Class. Birds,* II., 324; *Phœnicophæus viridirostris,* Eyton,

P. Z. S. 1839, p. 105; ***Bubutus Isidorei***, Lesson, figured in one of the plates to Bellinger's Voyage, as I am informed by Mr. Jerdon. Length twelve inches and a half, of wing four inches and a half, and middle tail-feathers seven inches, the outermost three inches and a half less; bill to forehead an inch and one-eighth, and to gape an inch and three-eighths; tarse fifteen-sixteenths of an inch. Colour of the upper-parts bright rufous-chestnut, except the head and neck which are pure light grey, together with the breast; the rest of the lower parts tinged with ferruginous, the flanks and lower tail-coverts coloured as above; volar feathers of the wings tipped with dusky, more developed on the primaries, and all the tail feathers tipped with white and subterminally with black; the legs appear to have been bluish. I am unaware whence the Society's specimen of this bird was obtained, but the species is included in Mr. Eyton's catalogue of a collection of birds from the Malay Peninsula, under the denomination cited.*

19. *Rh. chlorophæa*: *Cuculus chlorophæus*, Raffles, *Lin. Trans.* XIII, pt. II, p. 228; probably cited as *C. chlorocephalus*, Raffles, *P. Z. S.* 1839, 105; *Coccyzus badius*, J. E. Gray, and *Anadænus rufus*, Swainson, apud G. R. Gray (*List of the Genera of Birds*, first edit., p. 56). Length, of the largest specimen before me, thirteen inches and a half, of wing four inches and a half, and middle tail-feathers seven inches, the outermost three inches and three-quarters less; bill to forehead an inch and three-sixteenths, and to gape an inch and three-eighths; and tarse an inch. Colour of the upper-parts bright rufous-chestnut, as in the preceding species, and the volar feathers of the wings similarly tipped with dusky; but the head, neck and breast, are bright ferruginous, paler on the throat, the belly tinged with fuscous, and under tail-coverts blackish: tail and its upper coverts wholly dusky-black, the former tipped with white, and both crossed with numerous rays of a paler colour. The legs, according to Raffles, are bluish; and the naked space round the eyes of the

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* The *Cuculus melanogaster*, Vieillot, *Dict. Class. d'Hist. Nat.* IV, 570, would seem to be allied. "Taille, quinze-pounces. Parties superieures ferrugineuses; sommet de la tête cendré; rectrices longues, etagées, noires et terminées de blanc; gorge, devant du cou, et poitrine, roussâtres; parties inferieures noires: de Java." The plumage would thus appear to be intermediate to that of *Rh. rufescens* (?) and of *Rh. chlorophæa*.

same green colour as the bill, which is doubtless also the case with the preceding species. This bird, observes Sir Stamford Raffles, "inhabits the forests of Sumatra, but is not common. It feeds on insects, like the rest of the genus." The Society's specimens are from Singapore.

The more restricted Malkohas have been divided by Mr. Swainson into *Phœnicophæus and Dasylophus.*

Dasylophus is defined by him to have the "bill rather large, compressed in its whole length. Gonys angulated. Culmen convex, gradually arched. Frontal feathers incumbent, and concealing the nostrils. Feathers before the eye erect, forming a double crest."

20. *Ph. superciliosus*, Cuvier. (Red-eyebrowed Malkoha). Two specimens in the Society's Museum may, I believe, be referred to this species, though but partially agreeing with the description in the *Dictionnaire Classique,* which is the only one to which I have access. Length about sixteen inches, of which the middle tail-feathers measure eight inches and a half, the outermost being three inches and a half less; wing six inches; bill to forehead (in a straight line) an inch and five-sixteenths, and to gape an inch and three-quarters; tarse an inch and three-eighths. General colour dusky, brightly glossed on the upper-parts with greenish-blue, the tail-feathers white-tipped; the bare orbital skin not papillose, bounded above to beyond the eye with a white streak, and fringed above throughout its length with a singular erect range of rigid and glistening, narrow and discomposed, red feathers, the longest nearly an inch in length; bill apparently yellow at base, then shewing a sinuous deep green zone, and the rest pale green; in form more evenly compressed throughout its length than in the subgenerically restricted *Phœnicophæi.* A young bird is generally similar but less brightly glossed, the posterior portion of the red eyebrows much less developed, and the anterior portion yellowish in colour. The *Malkoha á sourcils rouges* described by M. Drapiez as *Ph. superciliosus,* Cuv., however, is stated to be but from ten to eleven inches (French) in length, having the under-parts of a dull white, but agreeing in all other respects. Should that here described prove different, it might be termed *Ph. ornatus.* M. Drapiez's bird is stated to inhabit the Philippines.

21. *Ph. Cumingi*, Fraser, *P. Z. S.*, 1839, p. 112. (Laminated Malkoha.) Length sixteen inches and a half, of wing six inches, tail

eight inches, bill an inch and a half, and tarse an inch and a quarter. This is at once distinguished from all other known species of *Cuculidæ,* " by the singular structure of the feathers of its crest and throat, the shafts of these being expanded at their extremities into laminæ, which may be compared to the shavings of whalebone; and in this respect they resemble the crest feathers of the Toucan to which Mr. Gould, in his Monograph, applies the name *Pteroglossus ulocomus,* but which is the *Ph. Beauharnesii* of Wagler, only they are not curled as in that species. The feathers above the nostrils, of the crest and chin, and along the middle of the throat, are grey at the base, have a decided white spot towards the middle, and are terminated by a broad expansion of the shaft, which is of a glossy black colour, and exhibits blue or greenish reflections; the external edge of this expanded portion of the shaft is minutely pectinated: the occiput and sides of the head are grey, passing into dirty-white on the cheeks and sides of the throat: the hinder part and sides of the neck, with the breast, are of a deep chestnut colour: the back, wings and tail, deep shining green: all the tail-feathers are broadly tipped with white: the vent, thighs, and under tail-coverts are dusky-brown, tinged with green: the bill is of a brown colour, and the feet are olive: irides red."

This beautiful species was obtained in the Island of Luçonia, of the Philippines, being termed *Ansic En Bicol* in the language of Albay. It is referred by Mr. Fraser to the present subgenus, though apparently devoid of the last character assigned to this by Mr. Swainson; and it would also seem, from the description, to want the usual naked space surrounding the eyes.

The subgenus *Phænicophæus* is restricted by Mr. Swainson to such as have the " bill large, very thick, smooth, resembling that of a Toucan in miniature [the nostrils, however, very differently placed]. Face naked [and papillose]. Nostrils basal, oval, close to the rictus; placed in a groove of the bill [not always perceptible], and defended by stiff erect bristles." Ridge of the bill more or less convex, in some obtusely angulated; its terminal half more compressed than the basal half.

Among these, Cuvier distinguishes, as having the naral apertures narrow and placed near the edge of the bill:—

22. *Ph. pyrrhocephalus; Cuculus pyrrhocephalus*, Gmelin; *Ph. leucogaster*, Dumeril. (White-bellied Malkoha.) I quote the following description from Latham. "The length of this bird is sixteen inches; weight four oz. Bill strong, very thick at the base, and bendi[illegible]downward; its colour greenish-yellow: top and hind-part of the head and neck, under the jaws, greenish-black, with a slender white streak down the shafts of the feathers, appearing, from the narrowness of those about the head, as numerous specks: sides of the head, and round the eyes, wholly bare of feathers, appearing rough or granulated, and of a reddish-orange colour [crimson in the living bird?], bounded beneath with white: the middle of the crown feathered: fore-part of the neck, back, and wings, greenish-black, with a gloss of green on the last: tail very long, cuneiform, greenish-black, appearing glossy in some lights, the feathers white for nearly one-third from the end: breast and belly white: the legs brown, with yellowish scales: wings reaching a little beyond the middle of the tail [an extraordinary elongation in this genus, and perhaps owing to the manner in which the skin described had been prepared]. Inhabits Ceylon, where it is called *Malkoha*. A specimen, in Mr. Daniell's drawings, was fully eighteen inches long, and named *Maal-Kenda-Ettah*." A[illegible]o said to inhabit Africa.

Others have round nostrils placed basally.

23. *Ph. viridis*, Lavaillant: *le Rouverdin*, Id.; *Ph. curvirostris*, Shaw, *Nat. Misc.* pl. 905; *Ph. tricolor*, Id., *Zool.* IX, 61; *Ph. melanognathus*, Horsfield, *Lin. Trans.* XIII, pt. I, p. 178, and *Cuculus melanognathus*, Raffles, Ibid. pt. II, p. 287. (Red-breasted Malkoha.) About eighteen inches long, of which the middle tail-feathers measure ten inches and a half, and the outermost four inches and a half less; wing six inches and a half; bill to forehead (in a straight line) an inch and a half, and an inch and three-quarters to gape; tarse an inch and a half. The bare skin around the eye less developed than in the last species, but still large and extending forward to the bill, being of a bright red colour in the living bird; the irides dark; and feet lead-coloured. Back and wings dark and glossy bluish-green, continued along the rump and two-thirds of the tail in one specimen before me, while in another the entire central pair of tail-feathers is of this hue, and there is more of it on the rest

of the tail-feathers than in the other; head dark ashy, as also the chin and feathers bordering the lower part of the orbital skin in the second specimen above mentioned; the rest of the under-parts deep chestnut-rufous, more or less paler on the throat, and darkening to maronne on the belly and lower tail-coverts: in the first spec[illegible]en mentioned, the outermost tail-feathers are almost wholly maronne, and the rest successively more so to the middle pair, which have only their terminal third of that colour: bill glaucous-green, the basal half of the lower mandible coral-red towards the middle.

Sir Stamford Raffles states that this bird "feeds on insects, and not, as has been reported, on fruits. It is found on the hills of Sumatra and the neighbouring [peninsula and] islands, but is not easily procured, as it commonly perches on the summits of the highest trees." It is described also to inhabit Africa.

24. *Ph. tristis: Melias tristis*, Lesson; *Cuculus Sumatranus*. Raffles, *Lin. Trans.* XIII, pt. 2, p. 287. (LITTLE MALKOHA.) Length of a fine specimen fifteen inches, of which the tail is nine inches, its outermost feathers four inches and a quarter less; wing five inches; bill to forehead (in a straight line) an inch and one-sixteenth, and an inch and three-eighths to gape; tarse an inch and one-eighth. Entire upper-parts closely resembling th[illegible] of the preceding species (*Ph. viridis*), except that the tail-feathers are wholly greenish and white-tipped: under-parts of a dark ash-colour: orbital skin tolerably large, and bordered above with a slight streak of white: some have a tinge of rufous about the breast. Inhabits Sumatra and the adjacent peninsula and islands, where it lives (according to Raffles) upon insects; and it was also obtained by Dr. McClelland in Assam.

In *Ph. tristis*, the bill is more compressed than in *Ph. viridis*, and the ridge of the upper mandible is obtusely angulated throughout, instead of being quite rounded and bulged towards the base, as in that species; the inferior margin of the upper mandible also curves much further downward, overlapping the base of the lower mandible. In the next two species, the bill is still more compressed and proportionally smaller, asuming nearly the same form as in *Xanclostomus*, wherein Mr. Jerdon has even placed one of them. It is possible that either the *Taccocua* of Lesson, or the *Calobates* of Temminck, may refer to this form.

(To be continued.)

Notes, principally Geological, on the Tract between Bellary and Bijapore.

By Capt. NEWBOLD, *F. R. S. &c. Madras Army.*

No. 1.

The notes, of which the following paper is an abstract, were taken during a survey ordered by Government of that line of Post Road, connecting Bombay and Madras, which lies between Bellary and the ancient Mahomedan capital Bijapore. They commence from Bellary, comprising a line of 164 miles extending in a north-westerly direction through part of the Ceded Districts, the Nizam's dominions, and the Southern Mahratta country, crossing at right angles the courses of the Tumbuddra and Kistnah rivers as they hasten across the Peninsula from west to east, to add their tribute to the Indian ocean. The route chiefly lay over a vast undulating plain, constituting a considerable portion of the great plateau that is elevated on the shoulders of the Eastern and Western Ghats, and intersected by a few subordinate spurs, running nearly at right angles with the great lines of dislocation.

Ceded Districts from Bellary to Yailbenchi.

From Bellary to Courtney, a distance of eleven miles, extends a plain based on granite and gneiss, penetrated by numerous greenstone dykes. From Courtney to Yailbenchi, four miles, the plain continues, as before, covered with a superstratum of *règur*, or the black cotton soil of India, to a depth of from one to eighteen feet, in many places resting immediately on the gneiss and granite ; in others on an intervening bed of a calcareous deposit, somewhat resembling the travertin of Italy, though more nodular, and called by the natives *kanker*. It is burnt by them for lime. Like rows of flints in chalk, it is seen also in the lower layers of the *règur*, often with sharp projecting spiculæ of carb. of lime, which would have been broken off had the nodules been drift pebbles. Here and there, on the surface, and partly imbedded in the soil, greenstone occurs *en boules*, indicative generally of a subjacent dyke. Angular fragments of both yellowish and reddish quartz in many places literally strew the surface of the ground, which close to Yailbenchi, changes to a red clayey soil ; and, on examination, proved to be the result of the disintegration of a bed of micaceous hornblende schist, with gneiss here rising to the surface. Granite, greenstone, and a rock composed principally of a reddish foliated felspar, pierced by veins of the same mineral in a more compact form, and tinged of a delicate green by actynolite, are seen in the walls of the small fort here. The produce of the soil is principally cotton, and juari, (Holcus sorghum).

Ceded Districts from Yailbenchi to the Southern bank of the Tumbuddra.

From Yailbenchi to Devasamudrum, the *règur* continues covering the surface of the plain, mingled, in greater or less proportion, with the angular debris of the subjacent rocks just alluded to; except near the village of Soganhully, where it is interrupted by a bed of a rich red alluvial soil, deposited apparently in this low situation by a number of rivulets flowing easterly from the great tank, or artificial lake of Daroji. This rich soil deriving additional fertility from the water to which it owes its locality, produces rice and wheat in addition to other grain; and also sugar cane. In some places, however, it is impregnated with muriate of soda. A few native salt manufactories, indicated by small mounds on the banks of the rivulets, are visible on the left of the road.

From Devasamudrum, gneiss with its associated schists, mica, hornblende and chlorite, constitutes the prevailing rock to the bed of the Tumbuddra. Veins of quartz and felspar cross it in various directions, in which thin seams of an actynolitic felspar, of a lively green, not unfrequently occur. Near Hulhully, on the south bank of the river, a few dykes of greenstone and basaltic trap, containing augite, cut the gneiss in an easterly direction. Calcareous deposits, in the form of a nodular *kanker*, are seen in the rivulets running down the slopes of the plain to the river bed. The soil is *règur*, lying upon the gravelly detritus of the subjacent gneiss, &c., with here and there a thin stratum of *kanker* interposed. The cultivated vegetable products the same as before. The plants growing wild on the plain are principally the cassia auriculata mimosas, asclepias gigantea, and the jatropha glandulifera. The last named plant is almost confined to the black soil. The banks of the Tumbuddra at this point, are formed by an accumulation of silt, clay, and sand, brought down by the freshes. The bed is covered with a fine red quartzy sand.

Nizam's country from the North bank of the Tumbuddra by Tawurghirry to Cundigul.

The Tumbuddra is crossed by basket boats to Mustoor, the first village in the Nizam's dominions. The plain rises gently as the traveller proceeds northwards to Umaluti, a walled village about twenty-four and a half miles from Mustoor. Between this place and Tawurghirry, its surface is broken by the protrusion of a bed of milky quartz, rising into a broken ridge of small hills; from which a gradual, but stony, descent leads to the decayed town and fort of Tawurghirry. Springs of fine water abound, and with numerous rivulets, maintain an almost unfailing supply of water. The latter feed the Tumbuddra, the bed of which constitutes the drainage line in this part of the Nizam's territories. Judging from the quantity of *kanker* found on the banks of these tributaries, a large proportion of lime must be conveyed by their means to the Tumbuddra, and thence to the ocean. The *règur* continues to cover the surface of the plain, with but few breaks, from the Tumbuddra to Umaluti, a distance of upwards of twenty-four and a half miles, though not perhaps to the depth seen in many parts of the Ceded Districts. This circumstance might probably be accounted for by the slopes here having a greater angle of inclination, rendering the supercincumbent soil more liable to the denuding effects of floods, streams, and the heavy monsoon rains. The *règur* thus becomes blended with the alluvium washed down, and is seen as a stiff greyish mixed clay. Both the alluvial red soil and *règur* are impregnated with muriate of soda and natron. Salt manufactories are seen scattered over the country on the banks of the rivulets. Beyond Umaluti to Tawurghirry, the soil consists of the debris of granitic rocks; and is sandy, gravelly, or stony, according to situation, and state of disintegration. Near the bed of the Tumbuddra, I have before remarked, that the subjacent rock is gneiss and its associated schists. Quitting the bed, these rocks are less seen, while granite and greenstone constitute the prevailing rocks from Chuloor to Umaluti; the former occurs in bosses, knolls, and detached hills, with tors and logging stones, the latter in dykes and loose *boules.* From Umaluti to Tawurghirry, the granite rises in a more decided manner from the surface, taking a south-easterly direction. One of the most considerable of these elevations, is a range of hills a little south of the Tawurghirry road, called the "*Caradi Guddi,*" from being infested by a number of bears, which are attracted to this neighbourhood by the fruit of the dwarf date, that luxuriates in the low moist valley. A bed of white and red quartz assumes the form of a low ridge, covered with jungle, and over which the road passes, called by natives, from its white appearance, "*Pilla Guddi;*" and running S.S.E. Some of the quartz veins intersecting the granite, pass into hornstone with a splintery fracture. The granite is crystalline, and contains dark mica in scales; hornblende in small crystals; foliated reddish felspar; and greyish quartz in minute angular fragments. Hematitic iron ore exists largely near the bed of quartz: the slope of the ridge towards Umaluti is strewn with the slag and scoriæ of the furnaces formerly used for smelting it. The Hindus, I am informed, gave them up many years ago, owing to the exactions of their Mahomedan rulers. The agricultural produce of the soil is chiefly juari, cotton, and a little wheat; being at a distance from the river, it is indifferently watered; depending on the dews, springs, and the periodical rains. The majority of the springs about Tawurghirry are brackish—the formation granite, with reddish felspar, in clustered blocks, generally not rising above twenty or thirty feet from the surface. The soil around the town is reddish, arising from alluvium brought down the slopes of the ridge, and the disintegration of the granite rocks in the vicinity. It produces good crops of juari.

A little more than a mile N.W. from Tawurghirry, chlorite slate occurs in the bed of a rivulet in nearly vertical laminæ, interseamed with a reddish subcrystalline felspar, having a general direction of E. 10 S. though contorted and waving at various points: the general dip is to the N. About two miles farther on, a trap dyke intersects the schistose beds, running nearly East and West, and decomposes into a reddish brown soil. Three miles farther, near Idlapur, the chlorite, mica, and micaceous hornblende schists appear in the form of low hills, having an irregular direction; but which approaches that of the laminæ of the schists themselves. The chlorite schist predominates, and losing its chlorite, passes into both a ferruginous and a soft purplish shale, or slate clay, containing much felspar in a decomposing state. The summits of two or three of these hills were crested with a jaspery clay ironstone, with cherty quartz in parallel laminæ. A smoke-coloured vesicular quartz is found veining the chloritic slate, and a reddish tough subcrystalline *kanker* is seen in the hollows and sides of the hills. Large masses occur in the road side, imbedding small nodules of hematitic iron ore, which is profusely scattered in the bed of the rivulets. At Sassenhal, in the bed of a nullah, I found an angular block of a compact rock of a light ochreous yellow colour, having cavities lined with minute yellowish pyramidal quartz crystals. Passing still north-westerly from Idlapur, the hills subside into long wavy swells to Moodianur. The chlorite slate is seen penetrated by a rock of reddish felspar and quartz, in which chlorite is scattered in thin lamellæ, which passes into eurite imbedding minute green crystals of tourmaline. Actynolite occurs in thin veins with quartz, and imparts a fibrous and radiated character to the rock. The direction of the laminæ of the chlorite slate was found to be N. 55° W.; dip 58½°, S. 45° W.; general direction of joints N. 10° E.; dip 85°, E. 10 S. The larger beds of quartz conform in direction and dip to the laminæ or strike.

Ramtar River.

About half a mile beyond Moodianur, the left bank of the Ramtar river, running towards the Kistnah, presents a small section of the rock composing the hill, the base of which it washes. It proved to be quartz rock, irregularly tinged with oxide of iron in almost tabular masses, separated by fissures, having the appearance of stratification, dipping to the N. E. at an angle of 13°. As I could discover no interstratified bed of any other rock, I hesitate to pronounce these the lines of stratification. Globular masses of a porphiritic greenstone imbedding reddish crystals of felspar occur on the surface. This bed of quartz rock lies between the chloritic schist and felspathic gneiss, the latter of which is observed about a mile further on, with a similar direction and dip as the former. Veins and beds of a jaspery clay iron ore, with calcareous incrustations, occur in parallel laminæ to the gneiss, which extends into the Southern Mahratta country to Cundigul.

S. Mahratta country from Cundigul to Danoor, on the S. bank of the Kistnah.

Near Cundigul the chloritic slate again rises to the surface as a cluster of hills, having the same smooth contour as those of Idlapur, and crested with a similar jaspery rock. Kanker and calcareous spar occur in the seams; and the surface is strewn with nodular hematite. Many of the specimens of the slate effervesced with dilute muriatic acid, impregnated with lime, probably from infiltration of water, charged with this mineral. The dip is to the N. 45° E. at an angle of 70°, the strike N. 45° W. Passing over the plain at the foot of these hills, about quarter of a mile from the village of Cundigul, a dyke of basaltic greenstone, running E. and W. is traversed. The green chloritic slate in its vicinity acquires a dull blue hue; becomes hard and compact, and splits into prisms having smooth planes. The contortions of the strata observed at some distance from the dyke, may be perhaps attributed to the intrusion of this rock. Gneiss is again seen in the beds of the Nundawarghi nullahs, alternating with mica, hornblende, and chlorite schist. It is red, felspathic, and contains veins of quartz, felspar, and actynolite. The last mineral often occurs in the seams with a compact siliceous felspar, having a lively green colour, sometimes in drusy crystals, and lining the interior of vesicular cavities. A dyke of basaltic trap crosses the plain in a West by Northerly direction. At the village of Nundawarghi, I remarked a number of millstones composed of a fine white and red granular sandstone, the grains of quartz cemented together by a felspathic paste imbedding angular and rolled bits of a dark flinty slate, derived from the slate associated with the gneiss and of a ferruginous rock. These stones I was informed were quarried at Badami and Jalihal, the price from ½ to 1 rupee each. The red felspathic gneiss and associated crystalline schists are seen at intervals as far as Cumblihal, where I encamped in the plain. Here the gneiss becomes granitoidal, the red felspar still continuing six furlongs beyond Cumblihal; at the Muddi nullah it is seen alternating with micaceous schist. Dip 60°, E. 20° N. Nodular *kanker* of a faint red, and hematitic iron ore, strew the beds of the rivulets. Near Caradi, the granite loses much of its mica, consisting almost wholly of red felspar and greyish quartz, and assumes the character of a pegmatite and graphic granite. The green actynolitic felspar continues to intersect the rock in thin seams. At Coujaganur the Kistnah river is first seen: thence to Danoor, the tappal village near the ferry, the route lies along its right bank, to which the plain declines with a gentle slope that increases however near the river bed. Numerous streams cut the bank in their progress to the Kistnah, leaving intervening swells of ground, and rendering the road, which crosses them at right angles, uneven and difficult to traverse during the rains, when this tract is partially inundated by the river. In consequence of the thick superstratum of mixed alluvial and *règur* soil, few opportunities occurred of observing the subjacent rocks. Gneiss, however, was the one most frequently met with.

Right bank of the Kistnah.

On the ascent of a low hill a little beyond the small fort of Haverighi, a dyke of basaltic greenstone cuts the gneiss, running nearly due East and West, and slightly distorting the laminæ of the latter rock. Several ramifications are thrown off, one of which has a South-westerly direction. The trap here may be remarked splitting into prismatic fragments with smooth planes. The natives take advantage of this circumstance, and employ the stones thus ready formed in building.

Bed of the Kistnah.

In the bed of the river lie nodules of a reddish brown and white cornelian, chert, jasper, calcedony, cacholong, semi-opal with linear curved and angular delineations, and mocha stones. The pellucid pebbles are sometimes surrounded with an opaque *enduit* which adheres to the tongue, mealy externally, but hardening as it approaches the nucleus. The fracture of the inner part is semi-conchoidal, hardness from six to seven of Mohs' scale. Fragments of a dark coloured basaltic rock still adhere to these pebbles; which, together with their water-worn rolled exterior, indicate them to have been transported from the trap amygdaloids to the West. The swollen state of the river prevented any observation which the section of its banks might have afforded. The sides of the ravines, however, presented gneiss, with both white and red felspar, interstratified with micaceous hornblende schists. The latter has a fine and almost slaty structure, brilliant lustre, is easily worked, and split by the natives into long slabs for the purposes of building. Iron pyrites are disseminated. A trap dyke running to the East is crossed a little beyond Muddur. The strike of the gneiss, &c. though contorted in some places, runs E. 30 S. and dips at an angle of 60° to N. 35 E. The surface of the left bank is much the same as that of the right, it is covered with pebbles brought down by the river; among them I observed a water-worn bit of a grey limestone, probably brought down by the Kistnah from the plain at the base of the Western Ghauts.

Remarks on the Kistnah.

It may be remarked, *passim*, that the Kistnah is one of the most considerable rivers of India. It rises among the Mahavaleshwar hills, near the western coast, a little to the S. W. of Satara, and after crossing the peninsula in an East by Southerly direction, falls into the Bay of Bengal at Sippelar Point, a little to the S. of Masulipatam. During a course of about 700 miles, it receives the waters of the Yairli, the Warda, the Gutpurba, the Malpurba, the Bima, the Tumbuddra, and the Hydrabad or Mussy rivers. Its breadth from bank to bank at Danoor, previous to its junction with the three last streams, as taken by trigonometrical measurement by my friend Lieut. Kinkead of the Artillery, and myself, was found to be 1918 feet. The current was running rapidly, carrying the round wicker basket boats, in which we crossed, a considerable distance down the stream, in spite of all the efforts of the boatmen.

Accumulations of mud, silt, and sand are daily progressing on the banks, entombing the remains of alligators, fish, and fluviatile shells. This river is thought to be richer in gems than any other stream in India. As it flows through the Palnad Circar, diamonds, cat's eyes, onyxes, and calcedonies occur in its alluvium; also a small portion of gold dust at Paugtoor, in the Nizam's dominions. Near the frontier of the Ceded Districts, beautiful agates are found. Not far from its mouth are some of the diamond mines for which Golconda is celebrated, and at Paugtoor, it abounds with amethystine quartz.

S. Mahratta Country, from the North bank of the Kistnah to Gurdinny.

After leaving the bed of the Kistnah, the plain rises gradually to the North.. On the slope lie some scattered blocks of a fine grained granite, composed of crystals of reddish felspar, quartz, and a black glittering mica in minute plates. The superstratum of soil beyond the alluvium of the river is red and quartzose. Passing in a West by Northerly direction, we reach a long low descent, which slopes gently to the west, to the bed of the Hirri, one of the tributaries to the Kistnah: from this the ground again rises with an almost imperceptible ascent to the west, forming a shallow valley running almost due north. The Hirri river follows its course from Bagwari, flowing southerly to the Kistnah, into which it debouches a little above its junction at Capila Sungum, with the Malpurba. It forms the principal line of drainage of an extensive and fertile tract. Our route lay on the left bank of the stream. In the lower, or more southerly part of the valley, a felspathic zone, extending in an easterly direction and several miles broad, is crossed. This rock varies in lithological character, in some places assuming the form of a pegmatite, at others that of a protogine, being combined with quartz and chlorite. A few loose and imbedded blocks of a granite, similar to that found on the north bank of the Kistnah occur, rarely without rising to any considerable height above the surface. The felspathic rock observed in sections presented by the deep nullahs running down the slope of the plain, has a pseudo stratiform appearance, arising from nearly horizontal joints, which might be mistaken for the lines of stratification. It continues as the surface rock as far as the village of Gurdinny, near which it is overlaid by beds of a friable trap, approaching wacke, with an obscurely schistose structure, and penetrated by veins of an earthy carbonate of lime, calc spar, and quartz in crystals. It rises near the village into a small knoll, down whose declivity runs a rivulet, in the bed of which the first section of the great overlying trap formation of the Deccan met my eye. Depositions of *kanker,* both in beds on the surface, and veins penetrating the fissures in both rocks, occur in abundance; it is found in a pulverulent and concrete state: the nodules are not so crystalline as those that are seen in the vicinity of the older trap dykes, which penetrate the granite and gneiss of the Carnatic, the Ceded Districts, and Mysore.

S. W. limit of the great overlying Trap formation.

About two miles to the north, on the rising ground on which stands the little fort of Beylhal, the road is literally paved with the *boules* of trap, which, exfoliating in concentric lamellæ, leave circular and oval nuclei, the latter in their turn, however hard and compact, evince a tendency to a similar process of disintegration. This gives a singular appearance to the surface of the road where the rock is uncovered by dust; presenting a surface paved, as it were, with mere pebbles of compact basalt set in concentric rings of wacke. The nuclei remain prominent from their superior hardness. Calc spar of various shades of white, green, and pink, calcedony in perforated nodules, and in geodes exhibiting concentric annular delineations, and lined with minute crystals of quartz, semi-opal and jasper occur in veins imbedded in wacke.

S. Mahratta Country from Gurdinny to Bagwari.

At Umblanur, a walled village in the jaghire of the Mahratta chief Punt Pritti Niddhi, about three miles north from Beylhal, I found the nuclei to consist of a hypersthenic felspar, imbedding crystals of augite, fracture small grained uneven; streak greyish white. Bits of a dark flesh-coloured eurite, and a porphyritic rock composed of crystals of dark dull green hornblende, imbedded in a paste of a faint bluish green felspar, exceedingly tough under the hammer, occur in the plain. I searched, but in vain, for these rocks in sitû; although judging from the sharp angles of some of the fragments, their proper locality cannot be far distant.

From Umblanur, still proceeding northerly, to within three furlongs from the town of Bagwari, the route continues along the left bank of the Hirri. The trap is observed in the nullah beds to undergo many changes in texture and colour, even in the space of a few yards, from a compact heavy basalt to a friable wacke ; from globular to schistose; from black to red and a light brownish speckled grey. The laminæ of the schistose variety are often intersected by transverse fissures, which divide the rock into rectangular and rhomboidal prisms, similar to those observed in clay slate near the line of contact with a basaltic dyke. These again, by the agency of the mysterious law of crystallization, which is manifested in a greater or less degree, in both ancient and modern trappean rocks, from the microscopic atoms of augite and hornblende to the prodigious pillars of Staffa and the Giant's Causeway, often assume a pentagonal and hexagonal shape by exfoliation. By process of farther exfoliation the angles are worn away, and the prisms assume a globular appearance, which has led some observers to imagine them to have been erratic boulders subjected to the rolling action of water, or from their abundance, and the augite often found in them, to have been showered down on the surface by volcanic agency. Near Bagwari, the beds of the streams abound with *kanker,* indurated ferruginous clay, fragments of red and yellow jasper, trap, amygdaloid, and a few nodules of calcedony; the concave surface of the botryoidal varieties of this mineral not unfrequently exhibit a succession of pentagons and hexagons.

S. Mahratta country from Bagwari to Bijapore.

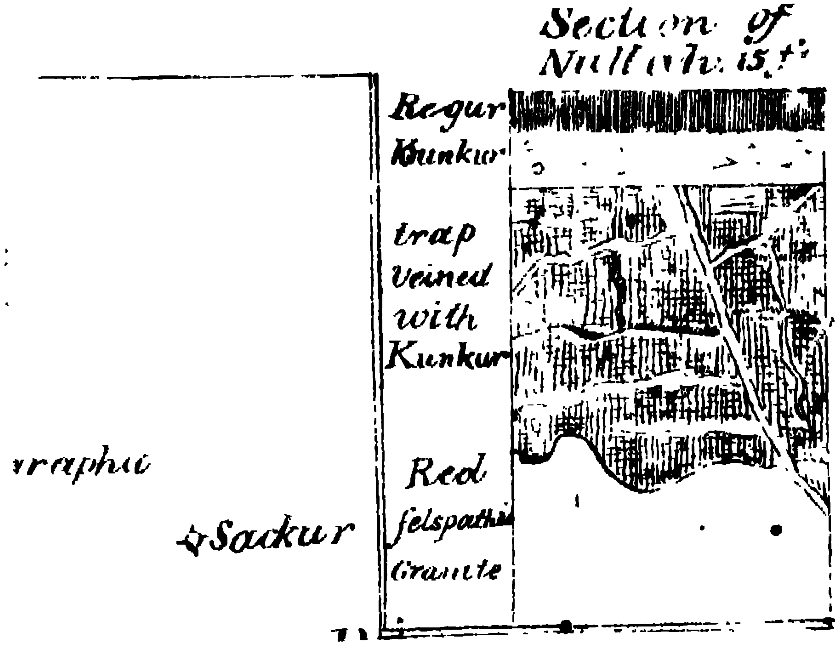
From Bagwari to Mangoli, the route lies over plains, the lowest stratum of which, as seen in wells, to the depth of twenty to fifty feet below the surface and beds of nullahs, is the overlying trap. About two miles N.W. from the former place, it is overlaid by a sheet of a conglomerate composed of a nodular and pisiform iron ore, and fragments of ferruginous clay imbedded in a travertine-like paste of carbonate of lime, coloured of a light ochre brown by oxide of iron. The bed of a nullah presented the only section (of this stratum); it was here four feet thick covered by a layer of black cotton soil or *règur,* and resting immediately on the concentric exfoliating trap which was penetrated by seams of a whiter and more earthy carbonate of lime, as shewn in the right hand corner of the plan.

Large masses of a lateritic rock, cemented together by calcareous and ferruginous matter, and having a smooth shining *enduit*, which imparts a glazed appearance to the surface, occur in the calcareous conglomerate. The extent of the latter, owing to the thickly covered nature of the soil, I was unable to trace; but it is met with at various places between Bagwari and Mangoli, and most probably continues, almost uninterruptedly, overlying the trap for the greater part of the distance; viz. twelve and half miles. Near Mangoli, the trap again appears as the surface rock, seamed however, and almost broken up, by the immense quantity of calcareous matter penetrating between the laminæ. The lime is seen to take up some of the colouring matter of the augite or hornblende of the trap, and is stained of a mottled green and brown. The trap exhibits superficial dendritic appearances, generally dark brown, with a yellow or brownish ground on the smooth surface into which it readily divides on being struck with the hammer. This facility of division arises from natural microscopic fissures pre-existing in the substance of the rock, sometimes visible to the naked eye. The fragments are of different shapes, but almost invariably angular, and frequently prismatic. The trap varies from a compact black and phonolitic basalt, to a loose light greywacke, speckled with minute ferruginous spots, and still preserves both the laminar and globular forms described above. Veins of a reddish colour, without any definite direction, are observed intersecting it. Their composition does not appear to vary much from the dull brown grey rock that forms the prevailing colour of the trap in this vicinity, except in being more ferruginous. Deep and nearly vertical fissures dipping generally to the W. 70° S. cleave its tables in a direction N. 25° W. A number of small vesicular cavities pervade its structure, the axis of whose longest diameter is generally N. and S., may be received as indications of the course here taken by this great *coulée* of trap.

City of Bijapore.

The view of the city of Bijapore, as the traveller approaches it from Mangoli, is truly striking, and peculiarly oriental. As in the distant view of Istambul from the sea of Marmora, spires, minarets and cupolas, some of which are topped by the crescent still glittering, the *donec impleat orbem* of Mahomedan ambition, now all crumbling into dust by the Almighty fiat, rapidly shoot up in succession to the view in the distant horizon. I entered the city by the Futteh gate, near which is the breach in the wall made by Aurungzebe's batteries, and rode through a heap of ruins, gardens, and tombs, (literally a city of sepulchres,) which extends nearly to the Shahpur gate, where there is a small bazaar. Beyond it, the elegant mausoleum of Ibrahim Ali Adil Shah, stands at a little distance from the city walls, nearly opposite the western, or Mecca gate, having an extensive garden in the rear. The tall and graceful minarets of this harmonious structure contrasted in their whiteness with dark masses of foliage in the back ground, throw a lightness and airiness over the whole, altogether enchanting. The gilded arabesque work, comprising sentences from the Koran, into which the screen of the mausoleum has been carved, is rudely shattered by the balls fired from the city walls to dislodge Aurungzebe, who had established himself in the mosque behind the tombs. Fascinated by the beauty of the place, I directed the camel drivers to ease their animals of their canvass load, and fixed on a spot shaded by some fine old trees as the site of my little encampment.

The staple articles of cultivation are red and yellow juari, (Holcus Sorghum); bajra, (Holcus spicatus); culti, (Glycine tomentosa); moong, (Phaseolus mungo); thoor, (Cytisus cajan); bullur, (Dolichos lablab); and white lobey, (Dolichos catiang). These are comprised in the Mungari, or early crops, and are generally sown in June and July after the early showers of the S. W. monsoon, and are reaped about the end of December. Cotton, wheat, white juari, the castor oil plant, and chenna, (Cicer arictinum,) are the staple articles of the late, or Hingari crops, and are almost invariably sown in *regur*, during the months of September and October, and cut about February or March. A quantity of caradi and kusum, (Carthamus tinctorius,) are sown with the Hingari crops, from which the staple oil of the country is chiefly produced. Cocoanut trees are but seldom seen. In consequence of the almost total absence of tanks, and other sources of artificial irrigation from which a constant supply of water can be kept up, but little rice is sown; the subsistence of the peasantry therefore is chiefly on cholam and wheat cakes. After reaping, the ryots have a custom of heaping up the straw in the fields, and covering the stacks over with a thick


Section of Nullah 15 ft

layer of the black soil, which is said to preserve it effectually from the ravages of animals and insects. In the Ceded Districts, it is generally carried off to the villages and there stacked. This custom of heaping it up in the fields is ascribable to the almost total absence of carts and bandies in the South Mahratta country and the Nizam's dominions.

The principal trees growing wild in the plains from Bellary to Bijapore, are the Acacia arabica, the Melia azadirachta, Butea frondosa, Ficus indica, Ficus religiosa, Spondias mangifera, and a tree called the "*Jummi*," held sacred by the Mahrattas.

The principal wild shrubs of the plain are the Cassia auriculata, the Asclepias gigantea, Indigofera cærulea, and several species of Mimosa. The Webera tetranda, Cassia fistula, the Zizyphus jujuba, Ixora parviflora, the Carissa spinarum, Carissa carandas, the Bander and Hingar, are generally found in the red soils, while the Jatropha glandulifera, as before stated, is almost confined to the *rìgur*. On the declivities of the granite hills, bushes of Euphorbia, Cacti, the Annona squamosa, and less frequently the Agave vivipara. That delicious flower, the Nerium odoratum, grows in abundance on the banks of the Tumbuddra. The tamarind and mango trees are seen planted in a few scattered groups or topes. The Solanum lycopersicum, the Calyptranthes caryophyllifolia, the Musa paradisiaca, and the Feronia elephantum, are seen in orchards near the villages.

Notes principally Geological, from Bijapore to Bellary, via Kannighirri.

By Capt. NEWBOLD, *F. R. S. &c., Madras Army.*

No. 2.

Geology of the plain of Bijapore.

The city of Bijapore stands on an immense sheet of overlying trap, with an undulating surface, though here and there small step-like descents, characteristic of trappean formations may be observed; but none of sufficient altitude to disturb, to any great extent, the generally level appearance of the surrounding country. As far as the eye can reach, on the north-west horizon are seen, from some of the higher points of the city, low, wall-like, ranges of sandstone. The almost unbroken extent of the plain of Bijapore affords but little scope for the geological examination of the strata subjacent: the observer must therefore dive into wells, pass up the beds of rivulets that water the surface, search for quarries, and descend into the fosses that surround fortified places. In failure of all these, the walls of forts and other buildings present a mineralogical collection on the large scale which usually affords a clue to the petrographical nature of the surrounding formations, as natives seldom trouble themselves to bring building-stones from any distance, preferring mud if the former material be not at hand. The surface of the plain is in general strewed with fragments of trap, amygdaloid, quartz, calcedony, opal, cacholong, calc spar and zeolites, kanker, nodular iron ore, and a conglomerate of ferruginous clay and iron ore imbedded in compact kanker. These decomposing together in unequal proportions, form a superstratum of a light brown soil, in which small crystals of a pearly calc spar and zeolite glitter like particles of silvery mica or talc, in soils formed by the decomposition of gneiss and granite. This light-brown soil is extremely fertile, producing abundant crops of wheat, chenna, bâjra and juari: it is very different in colour and appearance from the *rĕgur*, which I have seen covering with its black crust, rocks of all formations, at heights above the present drainage level of the surrounding country, the granite and gneiss of Bellary, a small part of Mysore, the limestone and sandstone of Cuddapah, and the states at the foot of the Nulla Mulla hills. Beneath this soil the trap, in public roads and other places liable to abrasion, is often seen in the state of the concentric decomposition alluded to in speaking of Beylhal, and also in a schistose form. In deep sections, such as wells and quarries, the rock assumes a tabular appearance, splitting almost horizontally into thick stratiform masses, which are again intersected, at right angles, by almost vertical fissures, imparting a columnar structure. At Turvi, a village about four and a half miles from the Mecca gate of Bijapore, beyond the ruined palace of Aurungzebe, the basalt rests conformably upon a bed of amygdaloid into which it passes. Large beds of the amygdaloid occur in the trap, rising above its surface, as seen near the Allahpur gate of Bijapore.

Fissures and joints.

The fissures, though nearly vertical, do not appear to indicate any axis of disturbance, dipping irregularly. At the bottom of a well at Tangoli, about fifteen miles south of Bijapore, the direction of the fissures was N. 25 W., dip W. 20

S., joints horizontal. At the quarries of Bijapore, the fissures took a direction N. 20 E., joints dipping 5° to E. 20 S. Calc spar occurs in thin discoloured seams, lining the fissures. A number of empty vesicular cavities pervade the rock, which appear never to have contained any mineral substance, and probably were occasioned by the evolution of gases while the rock was in a liquid state. Their direction is not uniform, but it will be found generally south-westerly, conforming to the axis of the trap's direction.

Petrographical structure of rocks.

The petrographical structure varies often in the space of a few feet, from a compact greyish black basalt, having a granular structure and conchoidal fracture, with streak of ash grey, to a soft wacké speckled with brownish decaying crystals of augite and amphibole. The trap in this vicinity has a blush of red traceable in the darker portions, and becoming stronger in the wacke and amygdaloid; the latter has for its basis, a fine red clay. The dark compact variety melts into a black glass, and is faintly translucent at its edges, exhibiting a dull green; the rest are opaque, and melt with difficulty into a greenish black glass. Some varieties, which appear to contain much silicious matter, are infusible. The less compact trap has an uneven fracture. When reduced to a coarse powder, a few of the fragments are taken up by the magnet; the fine powder is of dull greenish grey. It does not gelatinize when treated with acids. Its specific gravity I found to be 3.35.

The variety used in building the splendid palaces, mosques, and mausoleums of Bijapore is of a deep reddish brown opaque, and of a granular fracture, approaching earthy. This rich colour adds much to the appearance of the ruins. The rock is by no means uniform in texture, being more or less vesicular, amygdaloidal, or clayey, and subject to exfoliation: consequently, when the stone has not been carefully selected, it gives way under the superincumbent pressure; many of the structures are rapidly falling into decay on this account. The variable nature of the trap is perhaps most strikingly seen in making the circuit of the city walls, which are built upon the rocks from which their materials have been quarried. Not only is the disintegration seen in the walls themselves, but wherever they rest on an amygdaloidal foundation; which, exfoliating, splitting, and giving way, causes whole masses of masonry to be precipitated piece-meal into the fosse. Vertical fissures in the walls commencing at the base, and proceeding upwards, mark the site of future and extensive ravages. The masonry on the firmer parts of the rock is in excellent preservation : if well selected, it would make a good building stone, and is capable of receiving a fine polish, as shewn in the bas relief round the Sijdeh recess in that little gem of Moorish architecture, the Mecca Mosque within the citadel, which is constructed of the more compact variety of the purplish amygdaloid just mentioned.

The basis of the rock is felspar, with amphibole and augite in various proportions. The latter mineral (augite) is not much seen in the red amygdaloid rock. Olivine is of rare occurrence. Vesicles are seen in all varieties, both empty and containing green earth, which becomes brown or black on long exposure, calcedony, cacholong, calc spar, quartz, zeolites chiefly radiated, stilbite, heulandite, and mesotype, when it assumes an amygdaloidal stamp. These minerals also occur in veins, and are most abundant in the red amygdaloid, to which they impart a reticulated or porphyritic appearance, as they chance to occur in veins or crystals. Geodes of calcedony are seen also containing drusy crystals of quartz and of zeolite, enclosing crystals of carbonate of lime. I have seen veins of crystalline quartz splitting in the centre, in a direction parallel to the sides, containing all these minerals on their inner surfaces. Agates are sometimes, but rarely, found imbedded; greyish crystals of glass of felspar are met with in the semi-compact varieties; also small nodules of a compact cream coloured opaque zeolite with a faint tinge of buff, and marked with concentric annular delineations, resembling in shape those in orbicular granite.*

From Bijapore to Bagwari.

Marched this morning, (July 9th,) on the new route to Hukli, a place about twelve miles S. E. from Bijapore. The brown soil, arising from the disintegration of the subjacent trap continued about a mile, when it was succeeded by the *regur*, strewed with abundance of grey kanker in small nodules.

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* Some of these nodules are earthy, and have a powerful argillaceous odour. The most compact have a hardness about seven (Moh's) fracture semi-conchoidal, inclined to splintery—opaque. Before the blowpipe they intumesce, and phosphoresce slightly. They gelatinize when treated with nitric and muriatic acids. Some of them inclined acicular, microscopic and minute crystals of a mineral resembling chabasite.

At about three miles from Bijapore, the kanker and iron ore conglomerate occur in masses: the latter is used as a revêtment to a small well into which I descended, and found the water percolating through layers of kanker, dark earth, and iron ore. The fissures were nearly vertical; direction N. 5 E., dip S. E. by E. Trap, generally covered by a bed of reddish kanker, on which rests the cotton soil, passing into a reddish amygdaloid, reticular and porphyritic, containing calc spar and zeolites, continues to Hukli. Portions of its red clay basis intumesce, and curl up before the blowpipe, indicating the existence of numberless minute particles of zeolite disseminated throughout its substance. With muriatic acid, it formed a gelatinous mass; in this respect resembling the Silesian variety of basalt analyzed by M. Löwe of Vienna. Wells of fresh water are of frequent occurrence. The same formation continues to Bagwari. Between Hukli and Bagwari, a branch of the Doni is crossed, having black steep banks of cotton soil; this stream is a treacherous bed of saline and sluggish water, unfit for the use of man or beast. The earth of its banks is highly impregnated with muriate of soda, as shewn by the efflorescence on the surface, and by the adjacent salt works. About seven miles from Hukli, between Musibinahal and Bagwari, I observed a flat topped hill, about a mile from the left of the road. It was composed from base to summit of a tabular lateritic rock. Cuboidal masses of the same crowned the summit, exactly resembling the masses on the tops of the smooth laterite hills of Malabar and Canara. Farther east, about a mile, runs a low ridge of hills with a N. E. and S. W. direction; the flat contour, and waving direction of which powerfully reminded me of the laterite hills on the Western Coast. I examined the end of the range, and found it to be of the lateritic rock just alluded to; the rest also appear to be of the same rock. About twelve miles to the south of these, rise two other flat topped hills at Nagarwar, which I am assured by the natives, are of the same rock. The small hill of Hori Math, near Ingliswar, celebrated as being the site of the miraculous birth of the founder of the Jungum sect, is entirely composed of the lateritic rock. These lateritic hills are remarkable, as rising above the low trap elevations amid which they are situated, and are the only hills of any height to be seen for miles around. This circumstance, which is not of rare occurrence in other parts of India, is evidently the result of the denudation of the subjacent trap, the beds of laterite being once probably continuous over its surface. The trap is seen in the vallies and nullahs at their base, on which the lateritic rock rests in tabular, horizontal masses. A siliceous porphyritic rock, having cavities lined with minute brown crystals, is associated with this rock, and is found in loose blocks on the surface. The imbedding paste is a light coloured highly indurated jaspideous clay. Before the blowpipe *per se*, the crystals lose their colouring matter, but fuse with carbonate of soda into a white enamel.

Quarries of Bagwari.

Went about two and a half miles to the east of Bagwari, to see the quarries whence the compact blackish trap is dug, used in building the walls of that town; found the quarry to be nothing more than a large assemblage of basalt *en boules*, lying partly on, and partly imbedded in, the soil covering a long swell, probably a basaltic dyke, through the surrounding trap. I searched in vain for an excavation affording a section of the intrusion of the former. The basalt is different in mineral structure from that seen passing through the granite, gneiss, and slate of the Ceded Districts, the Nizam's dominions, Mysore, Malabar, and Canara. It is now amygdaloidal and vesicular, and contains small globules of calcareous spar, zeolites, and calcedony. The vesicles, however, are more usually empty: some of them contain a brownish yellow earth into which I have observed the zeolite to decay, and also calcareous spar, coloured with the peroxidation of iron, which exists plentifully as the black protoxide and carbonate. The fracture is conchoidal, fragments faintly translucent at the edges; streak, greyish white; melts before the blowpipe into an intense green glass. It contains little amphibole, and appears to be composed almost entirely of augite and felspar.

Lateritic rock of Hori Math.

The lateritic rock in the vicinity of Hori Math appears, generally, to contain more iron than the rock of Malabar and Canara, and is consequently of greater specific gravity. The specimens I obtained did not contain lithomargic earth, nor so much quartz as the latter; the tubular sinuosities are frequently lined, like those of the Malabar variety, with an ochreous earth arising from the decomposition of quartz and felspar, and tinged of various shades of brown and yellow by the oxide of iron; this earth forms a compact paste, cementing more firmly the component parts of the rock together: it exactly resembles in this respect, portions of the Malabar laterite. It is not so soft interiorly. This paste adheres to the tongue, and gives out an argillaceous odour when breathed on. The more compact parts of the rock, forming the coating of the tubular cavities, become magnetic before the blowpipe, and are converted into a dark grey slag.

From Bagwari to Alcopa.

Proceeding in a S. E. diretion by Jawannaghi and Narsinghi, to Alcopa, a village east of Umblanur, the road lies diagonally across the low trap swells which have generally a S. W. direction, though their lines sometimes intersect each other at obtuse and acute angles. The tops of the swells are mostly slightly convex, though often terrace-like, and are composed of the more compact and globular trap. In the banks of nullahs, the trap and amygdaloid may be observed alternating, and passing into each other: when they occur horizontally, the trap is generally the surface rock; this may be owing to its superior hardness, and capability of withstanding the abrasions caused by the elements. The amygdaloid contains irregular bits of decaying felspar and numberless vesicles, often filled with green earth and crystals of carbonate of lime. The former mineral, in moist situations, assumes a black or deep brown colour in decomposition, giving a speckled appearance to the rock, resembling that of the toadstone of England. Before the blowpipe, these dark spots are converted into black slag. In the bed of a stream, a few hundred yards N. W. from the village of Kunkal, I found slender prismatic crystals of carbonate of lime fasciculated in sheaf-like forms, with dark pieces of chert in a friable mass of the amygdaloid; the radii of the calcareous crystals were three inches in length, and of a faint amethystine hue.

About two miles to the north of this village, indications of a change in the formation were seen in the angular bits of red pegmatitic and quartz rock, that occur on the plain and in the beds of nullahs, which become more frequent as the villages of Kunkal and Alcopa are approached. A few hundred yards south of the latter, I found these indications confirmed, and the quartz rock in situ, in tabular masses in the bed of a nullah. Alcopa is situated near the south-eastern foot of a slope, on the top of which the trap has the usual compact and globular form; while at the base it is tabular, schistose, and amygdaloidal. A few hundred yards to the south of this village, the trap formation ceases at the foot of a low range of flat-topped hills of sandstone. In the hope of discovering the line of termination, I spent several hours in searching the beds of streams, and visiting the quarries in the neighbourhood, and at last discovered it in the bed of a nullah, about three hundred yards south of the village: here, after clearing away the gravel and detritus composing the bed, I distinctly saw the trap overlying the sandstone, and penetrating some of the numerous fissures that cleave the latter. I had anticipated this fact from the circumstance of the little disturbance in the latter rock, which occurs in tabular horizontal masses, having a rhomboidal shape from being intersected by fissures with a varied direction, but generally N. 65 W., crossed by others trending S. 20 W. Where the trap had penetrated them, I did not find the two rocks adherent, or passing into each other; but perfectly distinct and separate, and occasionally a thin calcareous seam intervening. Both the trap and sandstone seem to be slightly altered by contact, the former becoming less crystalline and more earthy, but often extremely tough, and splitting into small fragments, with numerous microscopic fissures intersecting its structure. The colour of the sandstone, from a few lines to several inches distant from the contact, is generally reddish, passing into a deep reddish brown. There was no appearance of semi-fusion, or intermixture, nor entangled masses of sandstone in the trap, a circumstance coinciding with the observations of Lord Greenock, in his account of the phenomena displayed by the igneous rocks in the neighbourhood of Edinburgh, in their relations to the secondary rocks: nor did I observe any solidification in the former, as noticed by Professor Hausmann, in the sandstone altered by heat near the blast furnaces at the Steinrennerhutte in the Harz: on the contrary it was of a looser texture than ordinary. In structure, from a loose and variegated grit, it approaches a compact quartz rock, containing disseminated portions of decomposed felspar, which falling out, leave a number of minute oval cavities. This stone is much used in building by the villagers in preference to the trap. I saw no veins penetrating the sandstone; pegmatite occurs in scattered blocks: the situs of this rock cannot be far distant, judging from the sharpness of the angles of these fragments.

From Alcopa to Talicota.

Proceeding in an easterly directions towards Talicota, the trap formation extends to the village of Mudkeysur, three coss from Alcopa, when it is succeeded by a bluish grey compact limestone, which I first observed in the bed of a nullah. No section occurred, shewing its contact with the sandstone; the surface of the country being covered with a thick stratum of soil, but from the easterly dip of both rocks, it is evident that the limestone is the uppermost. It continues the surface rock to the most easterly point of my observation; viz. Talicota. In a deep well at Munjghi, a coss west from Talicota, the bed of the Doni river and the plain in front of the Talicota fort gate, it occurs in stratified masses, with a very slight dip, varying according to the rise of the plain. In the well, the dip was only 2½° E. 5 S. Dividing the limestone from the surface to the bottom of the well was a fissure, a foot wide, direction S. 5 W., filled with a buff-coloured earthy kanker and angular fragments of the limestone rock. The latter in mineral character resembles the Cuddapah limestone, but is generally lighter in colour, varying from dark blue to pale buff or cream, and has few traces of pyrites.

The minerals associated with it, are hematite in small nodules, often occurring disseminated like strings of beads through its structure, which falling out, leave regular lines of small holes that resemble the perforations of boring insects, and the tubular sinuosities in laterite. Angular fragments of a buff-coloured jasper are strewed among those of the limestone, and from their variolated exterior, appear to have been in contact with the basalt, possibly limestone passing into jasper. I have often noted the Cuddapah limestone passing into chert, from contact with basaltic dykes. The softer and finer varieties of the cream-coloured limestone found in the vicinity of Talicota, are well adapted for lithographic purposes. Some of the specimens which I brought hence, were sent down to the lithographic establishment at St. Thomas's Mount, and found to answer. There is also a fine laminar limestone found in the bed of the river, with beautiful dendritic appearances between the plates.* The plain of Talicota is averred by Ferishta to have been the theatre of the overthrow of the Hindu empire of Bijanugger in A. D. 1564, where Ram Raj, its sovereign, was totally defeated and slain by the combined armies of the four Mahomedan kings of the Deccan; viz. those of Bijapore, Golconda, Bider, and Ahmednugger. Few, if any, of the present Hindu inhabitants of the place, however, had any tradition of this having been the site of the battle; and even Mahomedan historians differ, placing it farther south. Talicota is now, (1838,) the capital of a small territory held in jaghire from the British, by a Mahratta chief of the Rastia family, named Bala Sahib. It is situated in a plain on the left bank of the Doni river, which flows into the Kistnah, and separates the jaghire from the Mudibhat talook. The river is about 150 yards broad, and was easily fordable when I crossed it in the month of July. The banks are steep and clayey; the bed, as before mentioned, consists of great slabs of laminar limestone. Talicota is erroneously placed in some maps on the right bank of the stream. Besides the town walls, which are of stone, it possesses an inner fort, or citadel, in which the palace of the Rastia, a high stone house with small windows and loopholes, is situated. The palace has nothing but a guarded gateway to distinguish it from the substantial dwellings of the Bunnias and Lingayet merchants of the place. Near it, is the holy and celebrated Mahomedan shrine of the Five Saints, "*Durgah-i-punj-Pir.*" The pettah is large and spacious, and has a broad street, in which are the shops of the Jain venders of brass-ware, numerous calico printers, dyers, &c., for whom the place is noted. There is a small private Jaina shrine here, into which I was shewn by the Jaina merchant who accompanied me. It contained several white marble images of the principal *Tirthunkars*, brought from the north, (*Uttara Dés,*) together with the *Pancha Purmestri* in brass. There was also a brazen bas-relief of all the twenty-four *Tirthunkars*, the gigantic *Ardeswara* standing naked in the midst of the saintly group. The following is an approximative statement of the population of the town:—

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* A specimen of this dendritic limestone was examined for me, by Dr. Wight, who kindly afford me the following note: "The arborescent appearance in the slate I think an organic remain. At least I find, when under a high magnifying power, that the black lines can, with the point of a needle, be picked off without touching the stone, as if the carbonaceous matter of the plant was still there. I feel uncertain, however, whether to call the original a *moss* or a *fucus*, but think the latter."

Mussulmans, principally weavers and soldiers, ...	1,500
Vaisya Comptis, grain and provision sellers, ...	125
Mahratta dyers and cloth printers, ...	500
Lingayet cloth merchants, ...	1,000
„ weavers, ...	250
„ oil-makers, ...	50
Kunbis, agriculturists, ...	1,000
Carried over, ...	4,425

Brought over,	4,425
Mahratta tailors,	250
„ saddlers,	50
Brahmins of the Smarta and Vaishnavam sects,	500
Jains of the Vaisya sect,	15
„ „ Chsetriya sect,	25
„ „ Suryonsh Chsetriya sect,	25
Jain Upadi, or inferior priest,	1
Total,	5,291

Besides the above, there is a body of one hundred Mahratta horse and sibundies, maintained by Rastia; and a floating population of that wandering class of grain merchants, the Brinjaris, with whom the bazar was crowded. The revenue of the jaghire is estimated at about 10,000 rupees per annum. At the time I visited the place, Talicota was in charge of Nana Sahib Rastia. Bala Shahib, his elder brother, was engaged in a religious pilgrimage to Gungapur, on the banks of the Bima.

From Talicota to Mudibhal.

I observed the limestone to the S. W. of Talicota nearly five miles. About two miles farther in the same direction, the overlying trap occurs in the bed of a nullah, a little to the E. of the village of Gonahal, and continues for about a mile, when sandstone, in isomorphous masses, forms the surface rock, and is also seen in the bed of a nullah, in which lay angular blocks of both the above-mentioned rocks and fragments of the red pegmatitic stone. Trap prevails between Gonahal and Contogi: it is seen a little to the west of the latter village, overlying the sandstone in the bed of a nullah. The latter rock is here observed to separate into contorted laminar flakes of a reddish hue and friable structure near the line of junction: the former is earthy in texture, as before observed. A few feet from the junction, the sandstone resumes its usual texture and colour. Between the flakes calcareous incrustations have taken place. Between Contogi and Mudibhal, trap and amygdaloid are the surface rocks. Immediately to the west of the latter place, rises a low ridge of finely grained sandstone, where the quarries for millstones, for which Mudibhal has long been known in this quarter, are situated. The rock lies immediately under a stratum of *règur*, in tabular masses, intersected by vertical fissures running E. and W., and crossed by others at right angles: horizontal fissures also occur, dipping at about one and half to the E., these afford great facilities to the *Wudras* in excavating masses for pillars. A sort of pickaxe, wedge, heavy hammers, and levers are the only implements used: blasting is had recourse to, to split the larger blocks into pieces for the millstones. The masses of rock, though red, and variegated near the surface, are generally white and crystalline in the centre, having decaying portions of felspar disseminated. The millstones are shaped on the spot, and exported to the surrounding districts and to the Nizam's territories. They fetch from four to sixteen annas each; fire is not used to separate the masses, as in granitic rocks.

From Mudibhal to the north bank of the Kistnah.

A little west from the sandstone hills, the red felspar rock, with mica interspersed, occurs in unstratified knolls and masses. This continues to Hallighirry, whence the formation to the Kistnah is gneiss, with a few blocks of the granite protruding. A dyke of the crystalline greenstone occurs between Lepghirri and Hallighi, E. and W. direction. The Hindus rarely employ the overlying trap for building, preferring to bring sandstone or granite from a considerable distance. This is shewn in the old Hindu temple in Bijapore and villages in the vicinity of Contogi. East of Mudibhal the Idgah hill affords a good specimen of the globular trap; it resembles the greenstone dykes of the Ceded Districts, at a distance, in colour and contour; but the mineral character of the rock differs in containing little hornblende: it is tough, much less crystalline, and contains zeolite and calcedony imbedded in nodules. It decays into a deep red earth.

The Capila Sungum, or confluence of the Kistnah and Malpurba.

Crossed the Kistnah on the 15th July to Danoor and halted. Went to see the junction of the Malpurba and Kistnah on the 16th, about two and half miles west from Danoor. Crossed the Malpurba, about 200 yards broad, in a basket boat to the Delta, on the apex of which is situated the celebrated temple to the Lingum, in which Baswapa, the founder of the Jungum sect, finally disappeared, according to the version of his priests. The temple is evidently of great antiquity, small and not remarkable for beauty. I have a strong impression, that it was built by the Jains, from some peculiar symbols that have escaped the mutilating hands of their opponents, such as the two elephants with elevated trunks over Lachmi, &c. The temple faces the east, and the sacred Ling is covered by a hollow silvered head of Mahadeo, which was taken off for my inspection: expanded behind it, rises the silvered hood of a *Cobra de capello,* forming a canopy to the whole. There is nothing remarkable about the Ling, which is a small one blackened by libations of oil, milk, &c. I was not near enough to see the depression, or mark, said to have been left on it at the place Baswana was absorbed. Facing the Ling, in the ante-room, are two Baswanas, or sacred bulls. At the point of the Delta stands an Acacia tree. The two rivers were flowing with considerable rapidity, and their turbid waters mingled in curling eddies near a small temple, almost submerged in the waves, containing a Ling. The three Maths of the three Swamis here are in a dilapidated condition; that of Sencri Bharti is in the best state of repair. A brahmin performing *tapas* on a tiger skin, sat in a state of religious abstraction in one of the cells. The *Sthalla Puranam* of the place is in the hands of Ragovindra Achari, one of the three *Matha-mudras* whom I saw here; the names of the others are Sencri Bhat and Binda Achari. There are two *Sassanams,* one in the N. wall of the enclosure, the other near the ferry of the Malpurba in Hala Canara.

Rode from Cuddywal to Hunnagund, about five miles westerly.

Jain temple at Hunnagund.

There is a Jain temple situated in the S. E. extremity of a short and low range of hills; it is in ruins; the Gopar had been prostrated, and the sculptures considerably defaced. The temple fronts the east, and the doorways are flanked by mace-bearers in relief, with female figures on either side. The walls are decorated exteriorly with various sculptures: bayadéres, lions, elephants, &c. in alto relievo, and present a mass of elaborate carving. Bas reliefs of naked *Tirthunkars* are interspersed, the larger in a standing, the smaller in a sitting, posture. The extreme length of the arms of the former, which hang loosely down by their sides reaching below the knees, reminded me of the description of those of Rob Roy. The sanctum had been rifled of its idols, but I observed a large one reared up in one of the entrances, which possibly had been abstracted thence, as it has evidently suffered displacement. It is an erect naked figure in high relief, executed on a block of fine sandstone, with the short curly locks, (resembling a Welsh wig,) elongated ears, and peculiar contour, that characterize the Jaina saints : from the hood of the *Cobra* extended like a canopy over his head, I judge the image to be that of *Purswanath.* The features and other parts have suffered mutilation. The interior of the place, fouled by bats and other animals, is supported by massive stone pillars, generally square, with tori : the ends of the architraves are carved into lion's heads, &c. The whole is of a light red sandstone brought from Himallya, few coss off. There is an inscription in the wall of the doorway; another slab bearing an inscription in Hala Canara lies broken near the threshold. The earth and rubbish have accumulated up to the knee of some of the images. The range on which the temple stands, is a bed of elevated jaspery rock with contorted laminæ, and similar in appearance to that forming the copper-mountain ridge of Bellary. Direction N. W., dip 60 to 70 N. E.

From Sassenhal to the Tumbuddra.

From Sassenhal and Jumlapur to Nundapur, the road passes over the N. W. extremity of the Idlapur schistose elevations, before noticed. From Jumlapur, where the chlorite slate is seen at the usual angle of elevation, the ground rises for about a mile, when a narrow greenstone dyke is crossed, running E. 10 S. About 40 yards farther, the main dyke is traversed, running in an almost similar direction, which covers the summit and descent of the elevation with globular and angular fragments, almost as far as Nundapur, a distance of three miles. At the base of the elevation on which this village is situated, the slate is seen in the bed of the nullah, dipping at an angle of 60 N. 45 E., *i. e.* from the dyke. The schists on the western side of the dyke, observed yesterday at Sassenhal, dip at an angle of 72 to the S. W., *i. e.* from the dyke. The greenstone differs not from that usually seen in the Ceded Districts, being crystalline or porphyritic near the centre, imbedding crystals of a greenish felspar, and becoming more compact as it approaches the edges : amphibole and felspar intimately mixed, are its chief constituents. Near its eastern flank these minerals separate, and it passes into a sienite, which is exceedingly tough under the hammer : the felspar crystals fast decomposing, form a compact paste. The chlorite slate, in the immediate vicinity of these plutonic rocks, loses its fine slaty character, becomes thick-bedded, compact, and of darker colour, and is penetrated in every direction by contorted quartzose veins, the planes of which seem almost as various as their flexures. At the distance of a furlong and 100 yards S. E. from Nundapur, a red felspathic dyke occurs in the gneiss, almost concealed by a superincumbent mass of friable kanker: small crystals of a scaly graphite, with a shining steel-like lustre, occur disseminated in this vein. The gneiss alternates with chloritic slate and beds of a red felspar rock: its laminæ are much contorted, and have here an easterly direction. One mile and a furlong in the same direction from Nundapur, the bed of a stream is crossed, where a dyke of a compact reddish felspar rock (Eurite ?) cuts the gneiss in a direction of N. 60 E., flanked by a thick bed of reddish felspathic granite, containing both mica and chlorite in lamellæ, and a little quartz. This rock and the gneiss are much weathered. Six furlongs hence, the gneiss assumes a granitoidal form, appearing in rounded blocks with concentric exfoliations. Three miles from Nundapur, a trap dyke crosses the gneiss, running westerly; and another, at four miles five furlongs, having a similar direction. A furlong from this, a large dyke of the red euritic rock, about 200 yards broad, occurs in the same direction, flanked by a bed of the red felspathic rock, large beds of kanker accompanying the intrusion of the dyke. I saw an immense bed of this calcareous rock, lying as a flat table on the gneiss near Manadhal. From this place to Kannaghirry, a distance of eleven miles one furlong, gneiss, granitoidal gneiss, forming gentle elevations, and scattered surface blocks occur; the associated schists of chlorite and mica are less seen. A trap dyke occurs at the distance of five miles five furlongs from the former village; direction W. 15 N.

In the bed of the stream, forming in part the fosse of the fort of Kannaghirry, gneiss is seen alternating with mica and hornblende schists, both thick bedded and laminar. On the N. E. flank of the fort, a dyke of pegmatite, with a close small grained sub-crystalline structure, is seen passing through the gneiss, and in a direction parallel with that of the laminæ. In the latter rock, a vein, (five inches broad,) of large crystals of felspar and quartz running N. 25 E., exhibits a dislocation to the E. of seven inches. A fissure traverses it for some distance longitudinally, running also into the schist. The walls of the fissure are lined by quartz passing into hornstone.

About four miles North by West from this, near the village of Hanumanhal, I saw on the road side a monument of a Hirlu, or a hero slain in battle, evidently of high antiquity. It consisted of a slab of gneiss placed in a slanting position, on the surface of which a male and female figure were rudely sculptured in bas relief: the former was armed and in the attitude of combat; the latter, with uplifted hands, seemed in the act of throwing herself into his arms for protection. The relations and descendants place flowers and offerings of oil and milk, as offerings to the manes of the brave: the pious passenger deposits a stone, of which a large heap at the foot threatens to overwhelm the monument and the hero altogether. It is probable, many of the tumuli of loose stones observed in many parts of India, cover similar antiques.

Concluding Remarks.

I shall conclude these notes, with a few observations on what I term the great overlying trap formation of Central and Western India, the southern limit of which has been just described, in contra-distinction to the hills and dykes of greenstone associated with the granite, gneiss, and metamorphic schists of Southern India, which I take to be a distinct and more ancient rock.* The overlying trap formation has a south-westerly course; its southern margin terminating, according to Mr. Fraser, near Malwan, in latitude 15° 53′ N. and longitude 73° 47′ E. on the Western Coast of the Peninsula, and its northern limit between Bulsar and Gundavie below Surat, between the 20th and 21st degrees of North latitude. Its boundaries at Gundavie, according to Dr. Lush, are strata of clay containing kanker. Proceeding southerly on the sea coast between Bassein and Surat, horizontal strata of sandstone are seen resting upon it, supposed to be identical with the fossiliferous rock of Kattywar, and which may be accounted as the newest sandstone formation of India. Still farther south at Bombay, it is fringed by a recent formation of coral and shells; and N. of Malwan, it meets with the greenstone, granite and sienite of Southern India. Thus the western extremity of this formation occupies in its breadth, an extent of sea coast approaching five degrees of latitude. Proceeding inland in a N. E. direction from the vicinity of Malwan, its southern boundary may be described by a line drawn thence through

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* This opinion is chiefly grounded on the relative position, age of associated rocks, and mineralogical distinctions, which are very striking. The zeolites, chalcedonies, green earth, olivine and calc spars so abundant in the formation just described, are never or rarely seen in the trap a little to the S. of the Kistnah. The latter is never seen overlying fossiliferous rocks in continuous sheets, but occurs as dykes in granite and the older stratified formations.

Merritch and Gurdinny, a village about 40 miles S. E. from the city of Bijapore to Bider; thence north of Hydrabad to Nagpore; and from Nagpore north-easterly towards Sohagepore and Sagur to the 82d degree of East longitude, as observed by Franklin and Coulthard. At Gurdinny it rests on granite, a broad pegmatitic zone intervening. A little to the east of Gurdinny, at Mudibhal, on a crystalline sandstone; and at Nagpore on granite. Its north-eastern limit has not been accurately defined; straggling *coulées* of a similar trap, (containing olivine, calcedonies and agates,) have however been traced by the Rev. Mr. Everest as high as Gwalior, which lies in lat. 26° 15′ N. and lon. 78° 1′ E. It is said to extend still farther toward the east up to the Rajmahal hills: though it would appear that its continuity here becomes broken up. Assuming Gwalior as its north-east corner, we will return towards the Western Coast by the northern limit, passing from Gwalior in a south-westerly direction to Neemuch; whence taking a direction more southerly to Dohud, as traced by Captain Dangerfield, it passes by the east of Baroda to the sea near Bulsar, a little to the south of Surat. On this last line the trap was found, at Sagur, to rest on shell limestone, and on the limestone, greenstone, quartz, argillaceous, and talcose rocks of Oodipore. At Bulsar, as before stated, it is bounded by strata of clay and kanker.*

Such is the unparalleled extent of this vast sheet of trap, covering a space, with some interruption, of 250,000 square miles.

Since writing the above, I have had the pleasure of perusing Col. Sykes's admirable paper on this great trappean region, and perceive that he assigns to it an area of from 200,000 to 250,000 square miles only; but adds, however, that it appears to him that the above are not the absolute limits of the trap. My own observations, taken during journies to Bijapore, Bider and Culberga, will have served to trace its S. W. boundaries more distinctly than has hitherto been done.

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* It is probable that the amygdaloidal trap found overlying a bed of limestone, containing oysters, limnæ, small melaniæ, &c. at Peddapungali near Rajahmundry, and discovered by Col. Cullen, is an outlier of the great overlying trap formation.

Ancient Inscription found at Aden. Communicated to the Asiatic Society by the Government of India. With a plate.

No. 29 of 1842.

From Captain S. B. Haines, *Political Agent at Aden,*
To J. P. Willoughby, Esq.
Secretary to Government of Bombay, dated 29th September, 1842.

Political Department.

Sir,—I have the pleasure to forward to you the accompanying copy of an ancient inscription recently discovered in Aden, by the work-people employed in excavating the new road leading up from the Custom House.

2d. It is an interesting fact, that though Aden in its most flourishing era was the principal sea-port of the ancient Hymyari kings, that no Hymyaritic inscriptions previous to this have ever been discovered, either in the ruins of the ancient town, or its immediate vicinity; though on the shores of Hadramaut, and inland as far as Sana, many beautifully executed inscriptions have been found, and transmitted to Bombay. In every other case, however, the characters have been found on oblong marble blocks, generally forming part of a gateway, as at Nukbel Hajar, on the Hadramaut Coast; whereas, in the specimen now brought to light from a depth of twenty feet beneath the present surface of Aden, we have a circular slab of pure, and very compact white marble, with a raised rim round it, and apparently forming part of an altar. The inscription is not so well executed as many others that I have seen, but it is perfectly clear, without flaw or injury. In removing the stone, part was unfortunately broken off by the work people.

3d. The antiquity of this specimen may very safely be dated from the first year of the Hijera, when the last of the Hymyari princes reigned in Yemen. After the conversion of the Sabeeans to the Moslem faith, the altars erected to their gods were overthrown, and the religion of Islam universally prevailed. The character gradually became lost, as the Kufic writing spread over the southern and hitherto unconquered country of Yemen and Nedjran, and is now extinct. The learned professor, Gesenius of Germany, has succeeded in decyphering

and translating a small part of one inscription found by the officers of the "Palinurus,' during the survey of the South Coast, and it is only to be hoped, that this specimen may afford an additional clue to assist him in his valuable and highly interesting researches, regarding a nation that has been so utterly swept away.

4th. The inscription, it will be perceived, is a fac-simile, being an impression from the stone, and its accuracy therefore may be depended upon. I have the honour to be, &c.

Political Agent's Office, Aden, (Signed) S. B. Haines,
29th September, 1842. *Political Agent.*

(True Copy.)
(Signed) J. P. Willoughby,
Secretary to Government.
(True Copy.)
P. Melvill,
Assistant Secretary to the Government of India.

Meteors observed at Allahabad on the 10th of August, 1842. By Capt. Shortrede, *1st Assistant, Grand Trigonometrical Survey of India.*

The following observations were made at Allahabad, for the purpose of comparing them with corresponding observations to be made at Agra, but the gentleman at whose suggestion the observations were undertaken, was unable, from sickness, to take an active part in the business. Though the primary object was thus frustrated, it may be worth while to record these observations, with a view of calling the attention of those who may have opportunities of making similar observations about the 10th of August and 13th of November next.

The first step towards a knowledge of these meteors is a large collection of facts, and it is not to be overlooked, that in this country we have advantages for such observations which are scarcely equalled in any other part of the world, owing to the general clearness of our sky, the extent over which observations can be made, and the facility of intercourse by our common language, and the post routes everywhere.

The observations themselves are very easily made when a person knows exactly what he has to do, and does not allow himself to be distracted by attempting too much. Besides general attention, the most useful qualification I believe to be, the ability readily to estimate altitudes at sight. I know by experience, that persons in the habit of such observations, may train themselves to estimate altitudes at sight within 2° of the truth, for I have practised it along with another person, proving our estimates by an altitude and azimuth instrument. In the present observations, the altitudes I believe to be within 5° of the truth, and the azimuths within 15°. But as the meteors come sometimes very quickly after each other, there is no time for deliberation, and it becomes necessary to write down at once whatever is to be recorded, so as to be ready for the next.

In order to judge of the azimuths, I had my cot put in an open place, and laid duly East and West, because I had a straight road, with well marked objects in that direction. I lay on my back, and had a faint oil light on the ground, just sufficient to let me see my watch and what I was writing. I wrote lying on my back, and holding the paper over my head, and in this way saw several meteors which otherwise would have passed unnoticed.

It is an obvious fact, to whatever conclusions it may ultimately lead, that a considerable majority of these meteors have a Westerly course in or near to the Zodiac. Such being the case, it is desirable that some observers should be situated as nearly as may be at right angles to the Zodiac, and at considerable distances from each other, in order that the errors in estimating the altitudes have the least possible effect on the computed heights from the surface of the Earth.

In order that meteors observed at distant places may be readily identified, it is desirable that observers should set their watches either to mean or to apparent time, by means of an astronomical observation, or by a well-set sundial. Provided it be distinctly stated, whether the watch shews mean or apparent time, it is of no great importance which is used; though as a general rule, apparent time is the most convenient for meteorological observations, because the tides, &c. of the atmosphere, like those of the ocean, have a direct relation to the apparent, rather than to the mean course of the sun.

Appt. Time. of Obser.	Origin.		Course.	Length.	Remarks
	Alt.	Az.			
h. m.					
11·18	70°	S. W.	Nearly vertical.	25°	Faint.
11·23	40	S. W.	Vertical.	10	Very faint.
11·34	45	S. W.	..	15	Faint.
12·20	70	S.	..	..	Splendid from meridian 20° S. of Zenith towards 20° S. of Jupiter, train visible for one or two seconds.
12·23	..	..	..	5	Very small; from 20° S. of Zen. towards Jupiter.
12·27	..	..	..	8	From 15° N. of Zenith towards Jupiter, faint
12·39	45	N.	West	10	Small.
12·41	70	..	W. 20 N.	6	Faint, ended at 10° S. of *α* Cygni.
12·42	..	..	N.	10	From Milky Way between *α* Cygni, and *α* Pegasi. Sky clear, 25° above horizon.
12 50	90	..	N.	8	Faint.
12·54	45	N.	..	..	Very faint, towards *α* Cygni.
12·58	..	..	Westerly	..	From 10° E. of *α* Pegasi.
12·59	32	N.	..	..	From 8° above Pole-star : faint.
13·00	..	..	Westerly	..	From 20° N. of *α* Pegasi : faint.
13·04	30	W. 20 S.	W. 35 S.	..	
13·08	50	W. 15 N.	W. 25 S.	10	
13·15	80	S.	S. W.	15	Faint : cloudy towards N. and heavy E.
13·19	24	N. 5 W.	N. W.	5	Faint
13·22	..	..	W.N.W.	5	Faint : from 5° N. of Altair.
13·25	40	N.	W.	15	
13·28	65	N.	N.	10	Faint.
13·30	60	S. W.	S. W.	10	Very faint.
13·30½	70	S.	W. 20 S.	45	Brilliant.
13·39	20	W.	W.	..	Rather bright, but short.
13·48	35	W. 20 N.	..	..	From 8° S. of *α* Cygni.
13·49	..	..	..	..	Faint from near Zenith towards S. W.
13·56	..	..	..	..	From 15° S. of *α* Cass., cross meridian from 10° E. of Zen. to 40° below Zen. towards 40° S. of Jupiter.
13·57	60	S.	S. 20 W.	..	Towards Fomalhaut.
14·01	75	N.	..	..	Towards 30° W. of Fomalhaut.

Appt. Time of Obser.	Origin.		Course.	Length.	Remarks.
	Alt.	Az.			
h. m.					
14·02	..	S. W.	..	..	Another? uncertain.
14·04	90	..	..	..	Two from near Zenith, towards 20° W. of Fomalhaut: both faint.
14·04½	..	..	..	..	
14·08	..	..	..	..	Three within 20°s; 1st and 3d from 10° W. of Zen. towards Jupiter, length 20° 2d Northwesterly.
14·09	45	S. W.	..	..	Towards 5° S. of Fomalhaut.
14·12	..	..	..	..	From 15° S. of Altair to 10 S. of Jupiter.
14·13	40	S. 60 W.	S. W.	..	
14·14½	..	..	..	..	Three; two of them S. W., the other N. N. W., generally altitude about 40° at origin.
14·17	60	S.	S. W.	25	
14·18	..	S. W.	..	..	One S. W.; direction S. W. oblique.
14·18½	..	N. W.	..	..	One N. W., nearly vertical.
14·19½	40	..	W.	..	10° N. of Altair, direction West, vertical. Sky clear towards N., cloudy in E. horizon.
14·22	45	S.	S. W.	..	
14·23	60	S.	..	..	Bright from 30° S. of Zenith towards 15° E. of Fomalhaut.
14·24	..	..	W.	..	In Milky Way near *a* Pegasi.
14.26	70	S.	..	..	Two, 20° S. of Zenith, direction S. W.
14·26¼	70	S.	..	..	
14·27½	..	..	..	..	One N. W.; somewhat uncertain.
14·28½	..	..	S. W.	..	From *a* Arietis.
14·31	75	S.	..	..	From 15° S. of Zenith towards *a* Ceti.
14·32	45	S. W.	S. W.	..	From alt. 45° S. W. to 2° N. of Fomalhaut.
14·34	90	..	..	..	Brilliant from Zenith to between Fomalhaut and *a* Ceti; train luminous for about 10 seconds.
14·35	50	N. W.	..	..	In Milky Way at 40° N. W. from Zenith, direction in Milky Way Westward.
14·39	50	S. S. W.	..	..	Towards Fomalhaut.
14·42	..	..	..	..	Small, at 35° about *a* Cygni in Milky Way.
14·44	..	..	N. E.	..	Corruscating in Zenith, direction N. E.
14·44½	80	S.	S. W.	..	From 10° S. of Zenith.
14·48	..	..	W. 35 S.	..	From 10° S. of *a* Cass. direction W. 35° S.
14·49¼	..	..	..	..	From N. of Zenith towards Ceti. Cloudy and heavy all around, except to N., Left off observing.

Memorandum on the "Bora Chung," of Bootan. By A. Campbell, Esq., *Superintendent, Darjeeling.*

Fukeergunge, right bank of the Teesta, January 25, 1843.

The announcement of any extraordinary fact connected with the habits of men or the lower animals, produces three states of mind in the mass of those addressed; 1st, an unenquiring and implicit credence; 2nd, wonder, without any lasting attention to the matter narrated; and 3rd, sceptical disbelief. I have no doubt that the notice of the "Bora Chung", by Dr. Pearson, in Vol. VIII. of the *Journal of the Asiatic Society,* p. 551, produced all these states, in a great number of readers, for I have heard many express themselves to this effect; and I confess, that although I did not disbelieve the account of this fish's habits, I have been very anxious to make further inquiry into them. When in Bootan last year, it was out of my power to do so, but this year I have been more fortunate; and the following is the substance of the information I have gained:—The "Bora Chung" is not found on the right bank, or Rungpoor side, of the Teesta; it is confined to the Bootan side. It inhabits jheels and slow running streams near the hills, living principally in the banks, into which it penetrates from one foot to five or six. The tubes leading from the water into the banks are generally a few inches *below* the surface of the water, and consequently filled with water; they are sometimes of no greater diameter than sufficient to receive the fish, sometimes they are a foot wide; when of the smaller size, they terminate in a basin where the fish remains, returning to the water at pleasure. The usual mode of catching them is by introducing the hand under water into these recesses; two fish are generally found together, and they lie coiled up horizontally, resembling a wheel. They are eaten by the people of the Bootan Dooars, and are quite wholesome. It is not believed that they bore their own holes, or form their resting basins, but that they occupy the abandoned locations of land crabs. When in the waterpool or streams, they always remain close to the margin, and constantly move out and in, of their holes. They never leave the water, nor can they move on the grass more than any other fish. They are supposed to breed in the recesses described.

I have not as yet succeeded in getting specimens of the "Bora Chung," but expect to do so. I saw those sent from Darjeeling to Calcutta for Dr. M'Clelland. They were each about twelve inches long, of a dark brown colour, and scaly. If Dr. M'Clelland described them, they must be sufficiently known to Naturalists; but they may not have reached that gentleman; or, if so, their fate has been similar to that of fourteen species of fish collected in the Bootan Dooars last year, and forwarded by me to Calcutta for Dr. M. I have not had any acknowledgment of their receipt, and I conclude, therefore, that they never reached him.

Proceedings of the Asiatic Society.

(Friday Evening, 7th October, 1842.)

Dr. J. Hæberlin in the chair.

W. H. Elliott, Esq., C. S., proposed at the former Meeting, was ballotted for, and unanimously elected a Member of the Society.

Ordered,—That the usual communication of his election be made to Mr. Elliott, and that he be furnished with the rules of the Society for his guidance.

Library.

The following Books were presented:—

Books received for the Meeting of the Asiatic Society, on the 7th October, 1842.

The Calcutta Christian Observer, September and October, 1842. New series, Vol. iii. Nos. 33 and 34. Presented by the editors.

The Calcutta Christian Spectator, July 1842. Vol. iii. No. 7. Presented by the editors.

The Calcutta Literary Gleaner, October 1842. Vol. i. No. 8. Presented by the editors.

Proceedings of the London Electrical Society, 1841-42. Part iv. Presented by the Society.

Wilson's Antiquities and Coins of Afghanistan. London, 1841, 4to. (7 copies.) Presented by the author.

Wilson's Sanskrit Grammar. London, 1841, 8vo. (4 copies.) Presented by the author.

Ibraheem's Grammar of the Persian Language. London, 1841, 4to.

Ballantyne's Grammar of the Marhatta Language. London, 1839, 4to.

Ballantyne's Elements of Hindi and Braj Bhákhá Grammar. London, 1839, 4to.

Ferishta, (in Persian), fol. 2 vols.

Read letter from Moulvie Abdoollah, of 6th instant, submitting a copy of reprint of the 2nd Volume of the "Futawa Alumgiri," for inspection, and soliciting orders for the delivery of the copies to the Mohafiz of the Asiatic Society.

The vol. made over to the Moulvie of the Society for examination and report.

Read a letter of 31st March, 1842, from Chas. V. Walker, Esq. Honorary Secy. Electrical Society, presenting a copy of part 4th of the Proceedings of the Society, and requesting notice of its safe arrival, and of any regular channel through which to receive the future numbers.

Ordered,—That the thanks of the Society be communicated to the Electrical Society, and that Messrs. Allen & Co. of London, be named to Mr. Walker, as the channel for the receipt and transmission of all future numbers to the Asiatic Society.

Read letter from Mr. V. Tregear, of 8th September last, suggesting with reference to a Report of a Committee of Scientific Men appointed to consider the weights and measures at London, who recommend the decimal system, that a similar reform be proposed in Indian Coins, &c. ; also suggesting the change of title of the Society from that of the Asiatic Society of Bengal to the Asiatic Society of India.

Ordered,—That the first suggestion be referred to a Member of the Society competent to the task, to report on the feasibility or otherwise of the proposed introduction in India, to enable the Society to judge if it could go up to the Government with the proposal; and that as regards the second, the Society is of opinion, that the change was not desirable.

Read letter from Dr. J. Hæberlin, of 7th instant, intimating that according to the request of the President, he had examined the MS. work prepared by Dr. Wise, entitled "A Commentary on the Hindu System of Medicine," that the publication would form a most valuable addition to our store of knowledge, and might become a very useful auxiliary in many respects in the Researches of India; but that he was of opinion the Society should not publish the work at its own expence, but rather subscribe as liberally as it may think right for a certain number of copies.

Referred to the Committee of Papers.

Read the following letter of 7th instant, and enclosures from Major W. Hough.

To H. Torrens, Esq., *Secretary to the Asiatic Society.*

Sir—I do myself the honor to request you will submit a "Chinese Life Preserver," to the President and Members of the Asiatic Society, to meet this evening, together with the accompanying drawing, and explanatory paper. I shall be glad if it meets with the approbation of the Society, and that it may, by its public notice, be brought into general use.

I have the honor, to be, Sir,

Your obedient servant,

(Signed) W. Hough, *Major.*

Calcutta, Spence's Hotel,
7th October, 1842.

Report* of a Special Board of Officers assembled at Barrackpoor on the 23rd September 1842, by order of Major General Littler, Commanding, to test and report upon two Bamboo Floats, or Life Preservers, submitted by Major W. Hough, with a view to their being used, under the sanction of Government, in fleets of Troop-boats, when proceeding on the river, for the preservation of lives, in case of wrecks, or other accidents.

President.
Captain R. Smith, 28th Regt. N. I.
Members.
Captain Powell, M. B. and Capt. Tierney, 28th Regt. N. I.

The Committee have duly tested the Bamboo Floats submitted to them, and are of opinion, that in the event of a wreck or other accident, the use of the small one would save the life of any man who was unable to swim, "if properly fastened on," as it is sufficiently buoyant to keep the head and part of the neck above water, without any exertion on his part.

The large Float is capable of supporting four people by merely placing their hands on it, which causes it to sink six inches, and will bear the weight of three persons sitting upon it; but this plan appears objectionable, as it tilts up in every direction and throws them off, which would be very dangerous to those who could not swim; but were there two or three practised swimmers to guide and keep it steady, it might be capable of saving women and children.

These floats ought to be made of very dry kaguzee bamboos, each piece to have two or more knots, according to the size, which will make them the more buoyant.

A small "Jhalee," or Frame-work, introduced over the centre square of the large floats, upon which women and children might be placed, would tend to the preservation of life. (Signed) Ralph. Smith, Capt. and President.
John Powell, Capt. and Member.
E. T. Tierney, Capt. and Member.
(Signed) J. H. Littler, *M. General,*
Commanding at Barrackpoor.
(True Copy,) W. Hough, *Major.*

Note from C. B. Greenlaw, *Esq.*
Secretary to the Marine Board.

My dear Hough,—Many thanks for the Life Float. I think it the most admirable I ever saw. No ship ought to go to sea from any place where bamboos are procurable, without a quantity of them on board. Yours &c.
(Signed) C. B. Greenlaw.
(True Copy.) W. Hough, *Major.*

Government House, 7th October, 1842.

[*Extract.*] Dear Sir,—"I am directed by the Hon'ble the Deputy Governor of Bengal, to thank you for the inspection of the Life Preserver, of which he highly approves.

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* A copy sent by the General to the Commander-in-Chief.

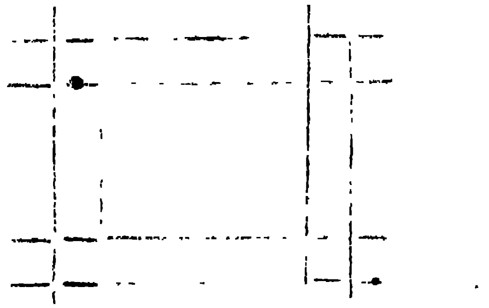
If you will have the goodness to forward it with an official letter to the Secretary to Government, it will be adopted by Government." (Signed) H. Spottiswoode,

To Major W. Hough, Calcutta. *Military Secretary.*

(True Copy.) W. Hough.

Origin of the use.

"In the year 1730, I was passenger in a ship from Batavia to China, 400 tons, (the Pridaæ, Francisco Xavier, Commander,) freighted by English, Chinese, and Portuguese. Near the Coast of China we met with a Tyfoon, (Taufong), which carried away all our masts, bowsprit, and rudder; six feet water in the hold — expecting every moment the ship would founder. The English and Portuguese stood in their shirts only, ready to be thrown off; but the Chinese-merchants came upon deck in a bamboo habit, which had lain ready in their chests against such dangers, and it was thus constructed; four bamboos, two before and two behind their bodies, were placed horizontally, and projected about twenty-eight inches. These were crossed on each side by two others, and the whole properly secured, leaving a space for their bodies; so that they had only to put it over their heads, and tie the same securely, which was done in two minutes, and we were satisfied they could not possibly sink. The shape is given below."—*From a letter to the Author of the Seaman's Preservative. Annual Register, vol. iv.* 1761, *p.* 141.—"*Useful Products.*" (True Copy.) W. Hough.



In 1834, the above was published by me, but not in a form to attract general attention. It occurred to me that I might save the two minutes, above noticed, by forming the "Life Preserver," at once, into two squares, ready for immediate use.

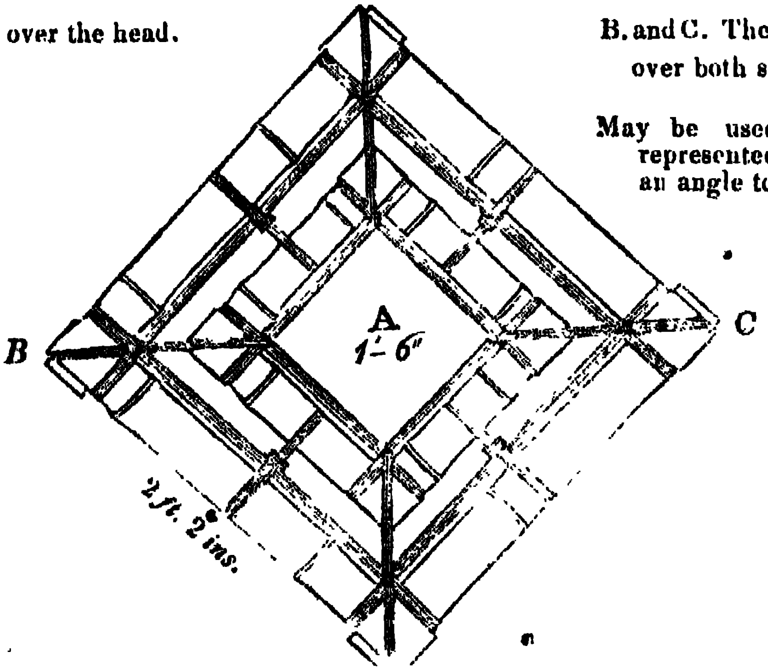
It seems to be adapted for use by fleets of Troop-boats, proceeding up or down any river, or in the case of Troop-transports, or indeed, for ships generally, for either boats or ships wrecked in the middle of a river, or at sea, or coast, or ashore, it will render safe many valuable lives. The soldier or sailor, may place it under his cot or hammock. If made on a larger scale, it might be the means of saving boxes, containing valuables or papers, now, often lost in boats proceeding up the Ganges, &c.

The loss last month of two officers, sixty-eight men, six women, twelve children, of H. M's. 50th and 62nd Regiments, and a great number of natives, suggested to me to request Major General Littler, commanding the Division, to test its use before a Committee, which assembled in his presence. I since submitted it to Government for immediate adoption, a division of the 9th Lancers being on the eve of departure from Calcutta to Allahabad by water. I had often tested its utility myself, but I thought that a formal report would be more satisfactory; and it has been reported to His Excellency Sir Jasper Nicolls, Commander-in-Chief in India.

W. Hough, *Major.*

Calcutta, 7th October, 1842.

The Chinese "Life Preserver," as modified by Major Hough. *First known to the English in* 1730, *vide Annual Register, Vol.* 1, 1761, *p.* 141.—"*Useful Projects.*"



A Placed over the head.

B. and C. The arms thrown over both squares.

May be used as above represented; or with an angle to the front.

To be made of kaguzee bamboos. The knots to be cut just at the ends; if in the middle between two knots, water would get in and make them less buoyant. The frame of eight bamboos is fastened by string at the angles, and in the centre of the sides, and should be tarred, or dammered over, to prevent the string becoming rotten. There should be a strong wooden pin to fasten the bamboos at the angles. The above is made with two knots in the inner square, of large bamboos, the outer may be of common bamboo. Those of three knots would support three or four men. Smaller might be made for children. By fastening a rope to the float, and then to the arm, or round the body, it never can drift away.

W. Hough, *Major.*

Calcutta, 7th October, 1842.

Read the following letter addressed to the Secretary by M. Garcin de Tassy.

Monsieur, *Paris*, 53 *Rue St André des Arts, ce* 9, *Juillet* 1842.

Sous les auspices de mon honorable ami M. J. B. Tassin, qui m'a fait l'èloge de votre caractère serviable, je prends la liberté de m'addresser à vous pour vous exprimer le desir que j'ai d'obtenir une *Biographie originale des Poëtes Hindous*, si un pareil ouvrage existe. Le *Bhakta mâl*, dont M. W. Price a publie de nombreux extraits, peut jusqu'a un certain point remplacer cet ouvrage, puisque la plupart des chefs des sectes Hindous dont il y est questions ont auteurs de poësies Hindous. Mais je n'ai pas cet ouvrage complet; s'il existait à Calcutta et qu'on peut en avoir une copie, je vous serais bien obligé de me la procurer. Pourriez-vous aussi me procurer quelques poësies de Kerbir accompagniès d'une traduction en *Urdû,* ou du moins de quelques notes, interlineaires, ou marginales, soit en *Urdu,* soit en Hindi ou en Persan? Vous n'ignorez pas que ces poësies, tres remarquables du reste, sont fort difficiles à entendre. J'ai un MS. complet du *Bijak* qui en est la collection, mais une commentaire ou une traduction me serait souvent fort utile. Y aurait-il enfin moyen d'avoir un commentaire Hindi, ou une traduction Urdû du célèbre Ramâyâun de Tulsidas, qui a ete imprimé plusieurs fois à Calcutta? J'acquitterais de la manière que vous voudriez bien m'indiquer les frais que vous feriez pour moi, si vous avez la bonté de vous charger de ces recherches, ainsi que je l'ai fait dans le temps envers l'excellent M. J. Prinsep qui eut la bonté de faire copier pour moi plusieurs MSS. de la Société Asiatique. A cette occasion je dois vous dire qu'il y en a un, je crois, dont on ne m'a jamais reclamé les frais de copie. Si vous en avez connaissance, je serais bien aise de m'acquitter et je m'empresserais de la faire au premier avis.

Les renseigments que je prends la liberte de vous demander et les nouvelles copies que je solicite sont destinies à augmenter les materiaux du 2d volume de mon Histoire de la Literature Hindouis et Hindoustâni. La partie Hindoui est sans nul doute la plus interessante. Malheureusement c'est surtout celle qui laisse le plus a desirer. Vous contribuerez a rendre mon ouvrage plus complet sous ce point de vue si vous voulez bien continuer d'avoir pour moi la meme bienveillance dont m'honorait M. J. Prinsep.

De mon côté je m'estimerais heureux de vous être bon a quelque chose, tant a vous en particulier, qu'a tous les membres de la Société Asiatique de Calcutta, dans vos rapports avec l'Institut de France, ou avec la Société Asiatique que dont je suis Vice President. J'ai l'honneur d'etre

Monsieur,
Votre bien dévoué serviteur,
GARCIN DE TASSY.

Read the following Report from the Curator:—

SIR,—On the present occasion, I have little to Report to the Meeting.

A fine, nearly full-grown, male of the white-browed Gibbon, or Hoolock, (*Hylobates hoolock,* Harlan,) has been received from Barrackpore, its skin has been mounted, and the entire skeleton has been set up. The deep black colour of this specimen contrasts strikingly with that of the mingled brown and blackish female noticed in the Society's Journal, Vol. X, 838, while the latter is much darker than in that styled *H. choromandus* by Mr. Ogilby, as this, in its turn, is deep-coloured in comparison with the pale skin obtained by Dr. Walker, which I exhibited at a former Meeting of the Society.

By C. S. Gullevie, Esq., the Society has been presented with a small collection of very interesting mammalia and birds, procured upon the Munpore Hills, on the eastern frontier of Bengal. The following species are comprised, of which those new to us I mark, as usual, by prefixing an asterisk.

Sciurus bicolor; an individual renewing its coat, and acquiring its hyemal dress, the hairs of which are longer, finer and less glistening, and of a considerably paler colour, than those of its summer garb, insomuch that the animal assumes a variegated appearance during the period of transition, the change commencing on the croup.

**Sc. erythrogaster (?)*, Nobis, *N. S.?* Size of the British Squirrel, or a little larger, and having a much longer tail. Entire upper-surface glistening deep reddish-black, minutely grizzled with light fulvous or yellowish-brown, each hair having thus two small annulations: the whole under-parts, from the throat, and inside of the limbs, a rather dark, but not intense, reddish-maronne: feet black with little trace of annulation; the fulvous predominating most about the head: tail similar to the back for the basal third, then gradually less grizzled, and the terminal half black, almost without grizzling; moderately bushy: whiskers black: ears not pencillated. Length nine or ten inches; the tail without its hair as much more, and with it upwards of two inches additional; tarsus, to end of claw of longest toe, two inches and a quarter.

* ***Buceros Nipalensis***, Hodgson, *As. Res.* XVIII, 178: a magnificent pair, male and female, of this splendid species, — the male having the head, neck, and breast, uniform rust-colour, paling on the crown, and the belly and thighs deep reddish bay.

Picus strictus (?), Horsfield, *Lin. Trans.* XIII, 176; *P. Sultaneus*, Hodgson; *P. Strenuus* (?) Gould. I have doubtfully followed Mr. Jerdon in referring this species to *P. strictus*, Horsfield, which is very briefly described *(loc. cit.)*, and although the latter part of the statement "*Pileus* maris coccineus, fœminæ aurantius," does not apply, inasmuch as the female of this Indian bird (which I have obtained in the vicinity of Calcutta) has the occiput black with round white spots. I am tolerably confident of its being the *strenuus* of Gould, included by Dr. Horsfield in his Catalogue of Assamese birds procured by Dr. McClelland; and there is a figure of it among the latter naturalist's drawings of his specimens.

Polyplectron chinquis.

From Dr. Spry,

Four specimens of a *Draco*, from Tenasserim.

From Mr. Peter Virre,

Hemidactylus: a species new to the collection, taken in Calcutta; the individual having a double tail.

Numerous specimens of various kinds have also been collected and set up, but not any requiring particular notice.

I am, Sir,
Yours obediently,
EDWARD BLYTH.

P. S.—The Mungoose from the Neilghierries, noticed in my last Report (p. 880), appears to be the *Herpestes fusca*, Waterhouse, *P. Z. S.* 1838, p. 55: it is less allied to Mr. Hodgson's *H. auropunctata* (which I have just received from that naturalist), than I had anticipated.—E. B.

The President forwarded for the Museum of the Society, two specimens of *Ornithorhynchus Paradoxus*, received by Mr. C. R. PRINSEP, from Van Diemen's Land.

ADVERTISEMENT.

The "Palæologica" I published in the year 1832, as well as my work on fossil bones of the country of Georgensmünd (1834) and my palæontological treatises contained in the Transactions of Academies and various Natural Societies, were so favourably received, that since some years I have been honoured with specimens of similar fossil organic remains of a former world, which on examination, offered important matter for results about fossil bones of the Mammalia, Reptiles, and Birds. Whilst these rare treasures were imparted to me by public and private collections of Germany, Switzerland, and the adjacent countries, with a readiness deserving every encomium, I am requested from different parts, not to publish my inquiries separately, but in a particular work. In order to satisfy such unbounded confidence and kind desire, I am willing to advance a work under the above title referring to the Fauna of a primitive world, which will contain my inquiries about fossil bones. As it is impossible to give a complete insight with this advertisement, it will suffice, to form a judgment of its worth, by citing, that this work, among the rest, will treat—of fossil bones of Pachydermata (Mastodon, Rhinoceros, Palæotherium, Dinotherium, Tapir, Microtherium, &c.), Ruminantia (Palæomeryx, Orygotherium, &c.), Rodentia (Lagomys Oeningensis), Carnivora (Harpagodon, Pachyodon, &c.), Tortoises, Sauriens, Frogs, and Birds, which have been found in beds of Lignite or Brown-coal in Switzerland and in other deposits of Molasse in this country, as well as in the pits of pisiforme Iron ore or Möskirch, in the calcareous marl near Oeningen, the gypsum near Hohenhoven, in the strata near Weisenau, and in other tertiary strata; of the skeleton parts of the marine Mammalia, called by me Halianassa, which very well designates the upper tertiary formations of our part of the world; of remains of Sauriens, Tortoises, and Birds from the cretaceous group (in the canton of Glaris, &c.); of the Plateosaurus from the Keuper; of the teeth of the

Ischyrodon; of Sauriens and Tortoises from the famous formation of the lithographic limestone of Solenhofen; by the co-operation of the President Baron Andrian and the Count Münster, of the remarkable Sauriens of Muschelkalk (Nothosaurus, Pistosaurus, Charitosaurus, &c.); and of the other fossil vertebrated animals.

As to the present eager pursuit of historical investigations about the constitution of the earth and the development of its organic types of animal life, there can be no better evidence than the remains of animals in the crust of the earth, amongst which the vertebrated animals are no doubt of the greatest importance. Thus if we add the creatures produced by the earth in a primitive age to number at present only, we are able to estimate the riches of the whole creation, and to explain the alterations resulting from the sublime laws of nature. I am confident, therefore, that the publication of a work like this, containing anatomical and geological discoveries of a former world, will be readily promoted.

The work will appear in several numbers, the price of which shall be calculated, as is customary with such works, after, the number of sheets in German, printed in Latin letters in gr. 4°, and according to the number of tables in fol°, with plates after my own drawings, or executed after my immediate direction. As gain is not the object of this publication, the lowest price cannot be determined before I know the number of subscribers; the number of copies will not exceed much the number required, and the price in every case, will not be higher than that of similar works. The subscribers will please to send their direction to the author by the post, or by well known libraries, but plainly written. The list of subscribers will be joined to the work.

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JOURNAL

OF THE

ASIATIC SOCIETY

Report of the Mineralogical Survey of the Himmalaya Mountains lying between the Rivers Sutlej and Kalee. Illustrated by a Geological Map.[*]

By Captain J. D. HERBERT, *Superintendent.*

To some of our Indian, and to many of our European readers, it may be necessary to explain the circumstances which gave rise to the following report, and those under which it has so long remained unpublished.

Captain Herbert of the Bengal Infantry, Deputy Surveyor General of Bengal, and Superintendent of Kemaon Surveys, was appointed by the Government of India, when under the Marquis of Hastings, to undertake a Mineralogical Survey of that part of the Himalya Mountains, which form the British Frontier to the North-West; but it would appear that this was not fully executed, though much was done; and the elements of much more which might have been accomplished at a small expence were already collected.

Captain Herbert, after editing for three years the valuable Gleanings in Science, the parent of our Journal, was appointed Astronomer to the King of Oude, whither he proceeded, but enjoyed for a very short time his post, dying of an apoplectic attack in 1833.

When our present Curator of the Museum of Economic Geology, Mr. Piddington, assumed temporary charge of the Museum, he found 12 cases filled with what were well known by the Assistants to be "Captain Herbert's specimens," but beyond this fact, not a line of Catalogue, Journal, or Note relating to the specimens could be discovered; It became then an object of great importance to the Society, and to Science, to trace out, if possible, any records which could throw light upon this valuable collection, and after a persevering search of eighteen months by the Secretary and himself, their labour was rewarded, first by the discovery of five volumes of Captain Herbert's Notes, which had been carried into KEMAON! but fortunately left there in the care of a zealous friend to Science, and a valuable associate of the So-

Introductory Remarks.

ciety, Mr. J. H. Batten of the Civil Service; next, by that of the report now published (to which Captain Herbert's paper on the Mineral Resources of the Himalaya in the Physical Transactions, Vol. XVIII. is a sequel,) and through the report, by the knowledge that his geological map, and plans of the river basins of that part of the Himalaya, exist in the records of the India House. It is needless to add, that no time has been lost in requesting copies of these valuable documents from home.

It remains but to add a word on the lacunæ which it will be perceived occur so frequently in the first pages of the MSS. These are owing to some corrosive liquid having so far destroyed the manuscript that it has been sometimes necessary to fill it up altogether conjecturally, but at other places there are enough of words or letters left to assure us, that we were not far from the very words used by Captain Herbert. It will be noted, that all our emendations are distinguished both by italics and by brackets.

INTRODUCTION.

1. It has been my intention to give, in the accompanying paper, such a general sketch of the geological features of the mountain tract between the Kalee and the Sutlej Rivers, as the series of partial and scattered observations which I have yet been able to make will allow. In the absence of every thing like information, such a sketch, though necessarily imperfect, and even premature, will not be perhaps without interest. It will at least serve to exhibit to the Government, who have so favorably distinguished me, the nature and extent of my labours since entering on this duty, and also to mark out the train of investigation which they have suggested to me.

As such I offer it, but with diffidence. Geology, as a science, has not yet attracted in India that attention which its importance merits, and it would be futile in me to deny that, till selected for this duty, I had but a slender acquaintance with the subject. While exploring the local phenomena of this tract I have been in reality studying the principles of the science; an advantage in so far as I may hope to have escaped the trammels of system. But on this account I have also laboured under some disadvantages, inasmuch as a premature account like the present, of an unfinished survey, may be expected to lie under some imperfections, which a little more technical knowledge on my part might perhaps have removed. "But a survey that shall accomplish every thing, must be a work of time, nor will any thing be contributed towards it by him, who fearful of being wrong where as yet it is impossible to be always right, and unsatisfied with the best he is able to attain, delays the record of his observations to the period of perfection." Should it be considered as redeeming in any degree the pledge of industry and zeal, which my acceptance of such an appointment must have held out, I shall consider its chief end answered.

3. Hereafter, when a more enlarged field of observation shall be attained, I trust I shall be able to make it more worthy the attention of the scientific geologist. Having once put on record what has been done, and digested it into something like a regular form, it will be easy to add to it as my researches extend and become more particular. One part will throw light on another. A particular fact carefully observed, may sometimes lead to a happy generalisation, and in this way many deficiencies will I hope be supplied which must necessarily attend so early an effort. In the meantime, imperfect as it is, this paper will have its uses. By exhibiting what has been done, it will shew what remains to do, and it will serve as a guide to direct any future labours, by pointing out in what quarter interesting facts may, or may not be expected to occur.

4. Considered as a geological description of these mountains, many blanks will be observed. For besides that, it was impossible in so short a time to go over every part of them, there is a difficulty peculiar to this quarter which very much interferes with geological investigation. This is the total absence of every kind of excavation calculated to afford information, whether mines, roads, or quarries. The former, few as they are, are inaccessible to any but those accustomed to them from their infancy. The total length of roads as yet laid open, does not much exceed 150 miles, and such is the light thrown on the subject along the different lines as to render it still more a matter of regret that we have not greater access in this way to the actual rocks, the nature of which is often only to be guessed at. Of quarries there are absolutely none, for the province, though possessing excellent limestone, slate, and other productions, capable of being turned to account, had been, up to the period of our conquest, so wretchedly misgoverned, as to have occasioned resources of this kind to lie utterly neglected. From the consequent difficulty of determining in many cases the nature or relations of the rocks, some particulars have necessarily been taken

for granted without actual examination, which in this case would have been impossible.

5. In the Geological Map I have laid down much that has not been actually examined, as might be concluded from what I have stated in my letter to Government, paragraph 7. To refuse to employ those generalisations which the experience of all geologists has shewn to be well-founded, is to forfeit the advantages derivable from the labours of our predecessors, and to impose on ourselves the task of reconstructing the whole science from our own materials. When the same rock has been found on the line of direction in every point in which it has been examined I have deemed myself justified in laying down that rock as continuous through those points. Even at the termination of the survey, many conclusions of this nature must be taken for granted; for it has been well observed, that "no human patience would suffice for the examination of every piece of rock that projects through the surface." And, even were that effected, still much must be taken for granted, especially in these mountains, the rocks being concealed, as they so often are, by deep collections of debris, and covered by luxuriant coats of vegetation. I was, however, in a very early stage of the survey, taught to except from this conclusion granite, as being a rock the occurrence or non-occurrence of which in any particular spot I found I could never predict with any certainty. Limestone also I found seldom could be depended on for any distance, forming always beds in other rocks, and never appearing under those relations which I conceive necessary to constitute a principal [*formation.*]

6. The elevations expressed in the sections,* have been determined by barometrical measurement, a method which unless under favorable circumstances, and with great facilities [*is liable to error, but*] the degree of accuracy attained is sufficient for the purpose, as it is a matter of no importance whatever whether the place of a rock be assigned fifty feet below, or above, its real level. They are as correct I believe as geological sections ever are, and certainly sufficiently correct to answer all the purposes for which they are required. The fixed points determined by the Trigonometrical Survey have been always

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* I regret that the circumstances under which this report has been prepared, have prevented the preparation of these. They are, however, more than half finished, and shall be forwarded with as little delay as possible.

used when they fell in the line, and they have not unfrequently been found of value as terms of comparison by which to judge of the accuracy of the barometrical results.

[*The nomenclature adopted, is that of MacCulloch's*] Hebrides. It were no doubt very much to be desired, that a system of nomenclature founded altogether on mineralogical distinctions, (like Brogniart's for instance,) should be generally received by geologists. It would save much useless and cumbrous description. Till such a reform, however, be introduced, the safest plan is to follow the example given in the above work, of noticing and describing correctly every compound included under any general head or term, as constituting a distinct geological formation. By this means the danger of confusion is entirely obviated.

Silt, sand, gravel, or boulder stones which are evidently derived from the breaking up of pre-existing rocks, and are of the latest formation, are all comprehended by Dr. MacCulloch, under the term " alluvium of transport." Professor Buckland was, I believe, the first to establish in a satisfactory manner, that there are deposits which may be discriminated as originating in two distinct causes, either in the action of the present rivers of the globe, or of a mighty rush of waters or deluge, far surpassing the greatest effect of rivers as they exist at present even in their highest floods. To the former, the term alluvium is restricted. The [*latter he distinguishes by the term* diluvium, *and though this cause may not have operated on every occasion, yet it is always useful to*] bear it in mind. Its reality in some particular cases is too obvious, at least in this quarter, to escape the notice of the most indifferent, or even prejudiced observer. I have therefore adopted these terms, considering them conducive to precision, and as having the sanction of such high authority. The angular fragments and rubbish, which are generally found either in their original position or only so far removed as may be traced to the action of gravity, are termed by Dr. MacCulloch, " alluvium in situ," and " alluvium of descent." I have ventured to use the term debris.

9. In the mineralogical details, I have adopted the nomenclature lately proposed in the system of Professor Mohs of Freyberg. The synonyms in this science have, it must be confessed, become too numerous, and the knowledge of them forms a very considerable part of the little that is to be learned from what are called systems of Mineralogy. To

adopt, then, a new set of terms may seem like increasing the difficulty of making ourselves intelligible, and wilfully adding to the confusion. But amongst the old names, there are none generally received, all being originally imposed in an arbitrary [*manner.*] But in the new terminology there are legitimate grounds for selection, the names being connected with a system of arrangement, which, if it be not all that could be wished, is yet extremely convenient. They express in a greater or less degree, the relations which these minerals have to each other; in other words, their places in the system.

There appears also little doubt but that, eventually, this system will be universally adopted, and those names supersede the present barbarous collection, not more puzzling by their numbers, than objectionable for the total want of euphony, and [*I have*] given some account of the mineral productions considered in an economical point of view, and with reference to the question of the due development of the resources of these provinces. Their value is not to be correctly estimated in the present condition of the country. When an improved system of government shall have had time to produce its full fruits in the increase of the population, and the improvement of its habits, in exciting a taste for the arts and conveniences of civilized life, and in effecting ready modes of communication, and effectual means of transport, it will be seen how many and [*how vast are the resources which here present*] themselves, which [*under good*] management, might be made sufficiently productive to become worthy of attention to a Government disposed to improve its resources and to leave no source of revenue neglected.

11. Gold and silver have in every age been sought after with avidity as the most prolific sources of national wealth. Nothing, however, can be more certain, than that, in reality, they are the least productive of all the several different mineral resources. The comparatively small quantity in which these metals are found, and the greater expence in raising them, satisfactorily account for this apparent paradox. In South [*America this is well known to the*] speculators in mines. It is there a common saying, that a copper mine is a fortune, a silver one scarcely pays itself, but a gold mine is ruin."

12. It is not then as considering the existence of the precious metals as the most promising, or the most productive, that I would lay stress on the great probability which there is of the discovery of a mine of gold

within these provinces. The reasons on which this probability rests, will be found in the Supplementary Paper.* Whether the discovery may in any reasonable period reward the zeal of an enquirer, or may wait finally that advanced stage of improvement in [*which all the resources of a country are carefully and accurately explored is a problem, the*] solution of which it were vain to seek. But of the actual existence of the metal within these mountains, no one can doubt who will read the few details I have given.

13. In the copper, lead, and iron, however, in which the province abounds, may be found a more tangible, as well as more productive source of wealth. It is certain that the former metal exists in very considerable quantity, and for the iron, nothing is wanting but a proper system of management to render it superior to that of England. To her repositories of these metals, of tin, and of the mineral coal, is England mainly indebted, [*for her vast wealth and power; and it is strange that they should be neglected in India, as if*] the truly valuable minerals were the gold of Potosi, or the diamonds of Brazil and Golconda. Why they should not here equally prove mines of wealth, if properly managed, appears difficult to understand. With the ore in abundance, fuel, and other means of reduction at hand, labour cheap, a very short line of mountain carriage, and half of that a line of made road, what is there, but capital and skill required to produce any quantity of the metal, and considerably under the present market price?

14. But these though probably the most productive, are not the only mineral sources of wealth * * * *
nearly its weight of silver, as even though it should not all prove to be of such first rate quality, yet the inferior kinds are also of such extensive use and application, as to render it a truly valuable deposit. Quarries also of marble, of slate, of potstone, of gypsum, supplies of sulphur, of sulphate of iron, and of alum are found. The trade in borax is well worthy of attention, and no doubt the whole supply of Europe might be drawn through these mountains. If to these be added other articles of trade and consumption, such as timber, hemp, bees' wax, wool, and live stock, as sheep, &c. it will readily be acknowledged in

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* Captain Herbert alludes here to his paper on " the Mineral Productions of the Himmalaya Mountains, " p. 236 Part I. Vol. XVIII. *Trans. As. Socy.*—Ed.

contemplating these [*provinces, that they are by no means so barren or so worthless as may at first sight appear.*] The indigenous population is not likely speedily to improve, or to enter into *these* views, at least without the support of European capital and the example of European enterprise. And certainly, if the experiment of European colonization is ever to be tried in India, we cannot select a better spot than these mountains, whether we consider the favorable nature of the climate, the great room for European improvements, the quantity of available land, or lastly, the nursery which such a colony might form of a hardy and warlike race to which we might in the hour of need owe the safety of the empire. [*But these views may be by many thought*] visionary, and [*I now*] turn to notice, before concluding these preliminary remarks, one other probable source of wealth, which though not, strictly speaking, belonging to these districts, is yet at no great distance from them; and to the discovery of which, should it be discovered, the geological investigations now going on must furnish the key. I allude to the strong reasons I have brought forward for believing in the existence of coal in some part of the Dooab; such a discovery would indeed be more valuable than that of a mine of the precious metals. In the great scarcity of fire wood, [*this mineral*] would be invaluable. When we consider too how completely the Dooab is adapted by nature to the ready formation of a complete system of internal communication, we shall be convinced that it would be sufficient to give an astonishing impetus to the march of improvement, and effect probably in a few years such a change as is difficult to form even an idea of at the present moment.

The following paper may be conveniently divided into five sections, the subject of each being as follows :—

1. Physical aspect and arrangement of the surface.
2. Geological details.
3. Recapitulation of the preceding, or general view of the geological structure.
4. Conclusion; with notices of the most remarkable features of the preceding general view as compared with systems, and with observation in other countries.
5. Mineral productions, comprising an account of the mines, method of working, and suggestions for their improvement.*

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* See Note at p. vi.

Of these the second being the most voluminous, and consisting entirely of practical details, can only be interesting to a professed geologist. [*It is my intention hereafter to label and refer each rock specimen of the large collection*] I have made to the account of its occurrence as here given, by number, so that, when the paper is studied with the cabinet to refer to, I consider that it will give as correct an idea of the geology of the province as could be had by actually travelling over it. And there will be the further benefit that the experienced geologist will be able to correct any mistakes into which I may have fallen, either through inadvertence or want of knowledge.

The first section constitutes a detailed and systematic account of the Physical Geography of this district, being the first ever given. Such a view independent of [*its connection with the geological details, to the full comprehension of which it is absolutely nebessary, is also much*] called for as a contribution to general Geography, the latest works published being singularly deficient in details on this subject, as well as erroneous in the few that are given. As an example, I would refer to Mr. Meyer's Geography, a very costly and bulky work, lately published, and to Brewster's and Rees' Cyclopœdias, (Art. Himalaya and Physical Geography.) In none of these works is a clear idea obtainable of the physical features of this interesting quarter of the globe. I could have wished to have had a little more [*time for the systematic arrangement of the facts and opinions in this*] division, and I intend to improve and extend it considerably hereafter.

The geological reflections with which the paper concludes are, I am sensible, those in which I stand most in need of candid criticism. The early period at which I have been obliged to draw them up, the want of books of reference, till within the last two months that I have been in Calcutta, and the necessity of attending to the arrangement, digestion, and revision of the other parts of the report during this time, thus distracting my attention ; added to the anxiety I have felt to [*do justice to*] the subject will, I trust, plead some excuse for the deficiencies observable in it. Altogether, indeed, I would state as a sufficient apology for the errors which may be found doubtless in every part of the paper, the great hurry entailed upon me in the preparation of the fair copy owing to the difficulties and perplexities originating in circumstances which I have explained in my letter accompanying.

But these hindrances are now I trust at an end, and with the assistance so liberally granted me, I am not without hopes of improving and adding to this paper so [*as to render it not altogether discreditable to myself, and I trust such as may*] embolden me to look forward to the patronage ot Government in the eventually contemplated act of publication.

SKETCH OF THE GEOLOGY OF THE HIMMALAYAS.

SECTION I.

1. Previously to entering on the detailed description which is to be the subject of this paper, it will be necessary to take a general but cursory view of the Geography of Central Asia. This great country, so interesting in every point of view, constitutes it is probable, whether we consider its physical aspect, or its geological structure, a system, or whole, without [*some general view of which to assist us, none of its*] parts can be fully [*comprehended.*] It is in their connection with this singular country that we shall see some of the most interesting relations of the tract in question. Nor does it appear possible to obtain a clear and connected idea of those relations, without extending our view to the great whole, of which our mountain provinces form but a part.

2. Unfortunately, however, so deep is the obscurity which covers the Physical Geography of Central Asia, that little is to be done beyond offering probable guesses on many of the most important points. The [*accounts of geographers and travellers, even those lately given to the*] public, are so meagre as to leave us little to glean. And even in that little they are frequently so contradictory, that it is not easy to obtain any thing like certainty, except as to a few leading features.[1] Even

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[1] It is quite astonishing how little we know even of countries comparatively easy of access, and often visited, I mean of their physical features. Of Persia we do not to this day know the elevations of its great plains and mountain ranges. Of Cabul we are equally ignorant. It would appear as if observations, amongst the easiest to be made, and requiring little skill or ability, have yet a mysterious terror for the otherwise most intelligent and able travellers. Our ignorance is the more provoking, as very near approximations to truth may be made in all the several results required by Physical Geography, with very slender means, and scarcely any science: how much may be done by a traveller possessed of only a pocket sextant, a good watch, a thermometer, and a pocket compass

these will throw perhaps some light on the subject, and will at all events enable us to take a view of this tract, altogether different from what has hitherto been adopted.

3. If we [*consider the map of Asia, we shall be struck with the appearance of a*] large central space, which is strongly marked by the circumstance of being but little intersected by rivers, while yet on every side innumerable streams flow from it, and unite to form some of the largest rivers of the Old World. The Amur, the Hoangho, the Yangtse-Kiang, the Maykaung, the Maygive, the Irrawaddy, the Kiendun, the Burampooter, the Ganges, the Indus, the Oxus, the Jaxartes, the Obi, the Jenisei, and the Lena surround with their sources this tract, and with courses varying from 1,200 to 3,000 miles in length, radiate from it to the surrounding seas in every direction.

4. Inasmuch as the source of every river must be higher than any other part of its course, it is just to infer, that the zone in which these rivers originate is higher than the plains through which [*they flow*] to seek the Ocean. [*Their*] lengths of course may be considered to be, within certain limits, proportional to the elevation of the source; we may further infer, that the line which connects the water-heads of these great rivers, must be of very considerable elevation, compared with other parts of Asia external to that line.

5. We know from observation, that the tract in which are found the sources of the Ganges, the Indus, the Oxus, the Obi, the Jenisei, and the Lena, is diversified by lofty mountains, some of them the highest on the globe. The Himalaya, the Karakoorum, the Hindoo Koh, the Beloor Tag, the Bogdo, the Alak, and the Altai mountains are all found along this line. We are then entitled to infer, that this mountain zone is in like manner continued to the S. E. and to the E., consequently that it completely surrounds the central tract.

6. Of the particular features of the interior, little is known. It has been usual to call it a plateau, and to suppose it of very great elevation. The great sandy desert of Cobi, which is known to occupy part of it, affords some grounds for this appellation; but with regard to the conviction of its great elevation, this seems to have originated in incorrect ideas of natural boundaries, and a consequent misapprehension of what is, or is not the central plateau. [*It has been*] presumed that the [*whole line of*] elevation along the mountain barrier above indicated should be

considered as the bounding limit, and that every point within this line was entitled to the above appellation.

7. Captain Webb, amongst others, appears to have fallen into this mistake in assigning the bed of the Sutlej (14,000 feet) as the lowest level of the plateau,[2] whereas the bed of the Sutlej belongs to the Sinditic Basin, (so in MSS. qu: *Ind*itic ?) and is consequently part of the barrier zone which surrounds the central tract. In like manner, the country visited by Captain Turner, and commonly known as Thibet, the description of which is generally adopted as that applicable to the interior, must be considered also as part of the mountain barrier, since it is watered by the streams or feeders of the Sanpo; which if it be not the Burampooter, must be either the Kiendun, or the Irrawaddy.

8. Considered [*as a question*] of Physical Geography, [*the true*] line of boundary is undoubtedly the chain of water-heads, and this is by no means synonimous with the line of greatest elevation.[4] It may be that the central tract is not of such great elevation as has too hastily been presumed. It may be that this presumption is correct; the mountain barrier which surrounds it serving, as in the [*case*] of the Ghats of Malwa,[5] to [*support*] a high table land of tolerably even surface. But however this be, it is not the less necessary to avoid confounding the boundary tract of mountain land with the central included area.

9. Of other particulars we are equally ignorant; what its rivers are, if any; and whither they flow; some we do know [*contribute to*] certain

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[2] The *Quarterly Review* in reporting this fact, has not noticed the error. But this work has never been celebrated for its disquisitions on physical or mathematical subjects. In this particular article, and the abusive one on the same subject which called for it, they are particularly open to censure. The two productions form an amusing contrast.

[3] The latter is D'Anville's opinion, the former Rennel's. The great mistake into which this acute geographer fell regarding the course of the Sutlej and Ganges, naturally makes one distrustful of his authority on this point. The little light which the employment of our troops to the Eastward has thrown on the subject, tends to add strength to these doubts.

[4] This remark is not unnecessary, for it is a mistake made by many, who conceive that because the source of a river must of necessity be higher than any part of its bed, *therefore* all the elevations in its immediate neighbourhood must be higher than those situated near a more advanced part of its course.

[5]. There is not however the analogy of geological structure to make this conclusion probable. Malwa is of the trap or overlying formation one which has derived *its* name from this peculiarity of structure, whereas all the evidence we have on the subject tends to support the opinion of this great circular barrier being composed by primary rocks.

lakes; and some [*we presume*] are lost in the sands of the Great Desert. But to obtain any thing like detail, on these and many other points, is in the present obscurity of the subject impossible. Of its geological structure, we have not an idea that is not purely hypothetical.[6] And yet, it may be averred, that the geology of Asia can never be rendered fully intelligible, or even the science itself be placed on a firm basis, till the whole of this tract be fully explored, and the rich mine of illustrations, which it doubtless contains, be fully laid open.

10. Considered in its various relations to Asia, I might even say to the Old World, it is undoubtedly the most interesting spot on the surface of the globe, and it is certain that the traveller who shall first succeed in developing these relations in all their bearings, will establish for himself no inconsiderable name. Unfortunately for science, this task is not likely to be soon effected. The jealousy of the Chinese government, to which the greater part of it belongs, opposing insurmountable obstacles to the progress of investigation and discovery.[7]

SECTION II.

11. It appears [*certain that*] this central area—whether we call it a plateau, a basin, or series of basins—is surrounded on all sides by a broad zone of mountain land in which originate the great rivers of Asia. The [*tract*] of which I am now to give a description, and which comprises all the British possessions within the mountains, forms but an inconsiderable portion either in length or breadth of this great Alpine belt. In interest of description, however, it does not yield to any part of it. For within its boundaries rise some of the most remarkable peaks of the Himmalaya summits, not more celebrated in the annals of superstition than in those of science, and from its area spring the sources which unite to form the Ganges. The sacred River! the fertiliser of pro-

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[6] That is of the interior.

[7] The extraordinary perseverance and intrepidity which distinguished the late Mr. Moorcroft, bade fair to give us some knowledge of part of this country, certainly of a great portion of the surrounding mountain tract, had his life been spared. Few men have possessed in an equal degree the qualifications necessary to ensure a traveller's progress through those countries, and it is not likely that an enquiring spirit like his would have rested while any thing remained to be learned, or any quarter open to research presented itself. His premature death, while on the point of returning to his countrymen, is much to be deplored. It is hoped that the materials collected may yet be made available to the increase of our knowledge of those countries.

vinces! the waters of which bear health and plenty through a course of 1,200 miles!

12. The boundaries of this tract are to the S. E. and N. W.; the rivers Kalee and Sutlej; to the N. E. a line drawn from the Kalapanee fountain, (one of the sources of the Kalee,) to the confluence of the Tedong river with the Sutlej; and on the S. W. by a line drawn from the Kalee, in latitude 29°, longitude 80° 8′, to Ropur, on the Sutlej. These boundaries form a right-angled trapezium, the two parallel and longest sides being directed about N. 60 W., the rectangular side being to the Eastward, and the oblique side to the N. W., forming angles of 50° and 130° with the parallels. The only exceptions to the regularity of these boundaries are: 1. A narrow strip comprehending part of the vallies of the Sutlej and Speetee rivers, which runs up as high as latitude 32°, and which is within the British limits. 2. The valley of the Jahnuvi river, or right bank of the Bhageerettee, which though included by the above boundary, is considered to be part of Thibet.[8]

13. The length of the several bounding lines are as follows :—

1. That facing the	S. W.	272 miles.
2.	N. E.	192 ditto.
3.	S. E.	96 ditto.
4.	N. W.	120 ditto.

and the superficial extent in round numbers may be taken at 23,000 square miles. If we include the slip of plain country along the S. W. boundary, and which is geologically connected with it, the extent will be about equal to that of England Proper.

14. The tract limited by the boundaries just particularised, may be described as altogether mountainous. A few inconsiderable and level spots, hardly to be called vallies, are found, but neither is their number or extent such as to render any qualification of this description necessary.

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[8] The only village, called Choongsa or Neelung, owes also a nominal subjection to the Rajahs of Gurhwal and Bissahir, whose countries are conterminous with this district. The villagers are of the Thibetan race. Their village consists of about sixty houses, which are but little raised above the ground and flat roofed, on account of the extreme violence of the winds which prevail in that quarter. It is situated on the right bank of the Jahnuvi, in latitude 31° 8′, longitude 79° 5′, and has an elevation of about 10,000 feet. The river is about 100 feet broad, and from four to six feet deep.

In ruggedness of feature, it does not yield probably to any country in the world, and such is the irregular and confused appearance, which the endless ramification of its mountain ranges presents, that it is with difficulty the unpractised observer can persuade himself that any thing like order or regularity can be deduced out of such a seeming chaos.[9]

15. No continuous chain of elevations can be distinguished on a first and cursory view; no great vallies, no table lands, nothing in fact to lend a clue to the development of the mountain masses. The aspect, from whatever height the country be viewed, is that of an assemblage of elevated peaks, irregularly and confusedly heaped together. Even the snowy chain, though defined to a certain degree by a phenomenon so singular on a first view to the inhabitant of the plain country, loses on a nearer approach all character of continuity and regularity, and appears under the same confused and irregular aspect which the lower elevations are observed to bear.

16. It is only by tracing the courses of the rivers and their tributary streams, that a clue can be found to lead the observer out of this labyrinth. By connecting their sources, and by following out the devious windings of the several feeders, an idea is obtained of the extent, the direction, and the connection of the several ranges. Such an analysis, (vide sketch of the great river basins,) will be found to modify considerably the notions which the first view of this mountain tract from the plains is calculated to give.

17. Instead of a succession of parallel and continuous ranges running S. E. to N. W., and rising one behind another in regular array and increasing elevation, till the series is closed in the farthest distance by the line of snow-clad peaks,[10] we see only one continuous range of any extent forming an irregularly curved line, which bends round the tract commencing on the N. E. angle, with a North-westerly direction,

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[9] This is also the arrangement, or rather apparent want of arrangement observed by Saussure in the Albs, who says, "When we contemplate the range of which Mont Blanc forms a part, from less considerable elevations, it appears as if these colossal mountains were situated in a line, and formed a chain, but this appearance vanishes entirely from the bird's-eye view here presented. They are distributed in great masses or groups of various strange forms," &c. &c.

[10] The deception is so strong in viewing these mountains from the plains, that most people continue, even after having visited the interior, to speak of the 1st, 2d, 3d, and snowy ranges

which it gradually alters to a South-easterly one on the S. W. angle, and latterly due South, just before it is lost in the plain country.

18. This range forms one of the boundaries of the basin of the Sutlej which bends round the convex side, while within its concavity, are contained the numerous sources of the Ganges, the several feeders of which are separated by a most intricate ramification. On this account, (as it will be necessary often to refer to it,) and as there is no native name for it, it may be termed the Indo-Gangetic chain.

19. We see then, that with the exception of a narrow strip belonging to the Sutlej, all this tract is occupied by the sources of the three principal branches of the Ganges; viz. the Jumna, the Ganges Proper, and the Kalee.[11] A line drawn through the points where they severally enter the plains, represents pretty exactly the common boundary of plain and mountain land. It is the S. W. boundary mentioned in Art. 12, and its length from Ropur, the *debouché* of the Sutlej, to Brihon Deo, that of the Kalee is 272 miles.

20. The great disproportion of drainage effected by the Sutlej, which is one of the boundaries, and by the other or Gangetic system, is very striking. Not less so is the difference of their courses as to direction, the one running nearly due West, the other South; and as to length, the former having a course from its origin in Lake Monsuror to its *debouché* at Ropur of 550 miles, whereas the longest branch of the latter has only a course of 292 miles. It is this want of analogy in the character of these two great river systems that forbid our speculating on the arrangement of surface which may obtain beyond them.

21. In the case of two rivers of such magnitude as the Indus and Ganges, which direct their waters to the opposite seas of India, we naturally expect to trace some indications, however obscure, of a separating elevated tract, something farther than the point where the Indo-Gangetic chain ceases. No such indications are however found, for the intermidiate tract is much at the same level as the interior of the river districts which it separates.[12] Physical Geography is full of these disappointments,

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[11] In terming the Kalee one of the sources of the Ganges, I mean of course the Ganges of Bengal; the Kalee is the principal branch of the Dewah or Gogra river, which falls into the former near Chuprah

[12] This fact is very important, and points out the facility of establishing a system of irrigation all over the Dooab and Rohilkund. I ascertained that the bed of the Jumna at Raj Ghat, on the road between Chilkana and Boorea, is but five feet

a proof, if it were wanting, that we are still but imperfectly acquainted with the structure of the globe.

22. The length of the Indo-Gangetic chain is about 340 miles, as defined on one side by the Kalapanee fountain, one of the sources of the Kalee, where our first precise knowledge of it commences, and on the other by its termination in the plain country, which is sufficiently sudden to be definite. From its gradually decreasing elevation along this line, it is natural to infer, that it is but a ramification of that more extensive line of water-heads, (Art. 5,) which would exclude from the central plateau all the mountain tract watered by the Sanpo and the Indus, as well as by the Ganges. We are not then to suppose that in crossing the Indo-Gangetic chain, we have made a near, or even the nearest appulse to the great table land of Tartary;[13] we are equally near it in the basin of the Ganges. But if this central plateau really means any thing, it must be something distinct from its surrounding barrier of mountain land, or if not, all the river basins are equally entitled to the appellation.

23. Next in extent to the Indo-Gangetic chain are the two principal ramifications; viz. that which separates the subordinate basin of the Jumna from that of the Ganges Proper, and that of the latter river from that of the Kalee. From their origin in the parent ridge to where they are lost in the plain country, their length is about 160 miles. Like the principal chain, they cease suddenly, nor is there any trace either in the Dooab or in Rohilkund of a continuation of them, however obscure.[14]

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below the level of the Saharunpore cantonment, (month of March.) At Badshahee Mahul, it is 200 feet. Here then is a water-head capable of supplying any number of canals, and for a continuance the Ganges offers similar facilities for Rohilkund. The elevation of its bed at Hurdwar is 1,000 feet above the sea, while that of Mooradabad is only 609 feet.

[13] The bed of the Sutlej can by no figure be termed a table land, for it is a deep valley shut in by lofty mountains. But even if it were, it is not the table land of Tartary, which is the country watered by the Oxus and Jaxartes. It is a strange mistake which is made, and by many who have the reputation of being well informed, that of confounding the Calmuck or Mongolian race with the Tartars, and their country with Tartary, whereas no two races can be more distinctly marked than these are. It was the country of Thibet, and not Tartary, which Captain Webb saw, and which is inhabited by a tribe of Calmucks or Eleuths.

[14] A levelling operation which I executed some years ago, connecting Seharunpore with the Jumna, and which furnished the result mentioned in the note, page xvii. established also a more unexpected conclusion; viz. that the ground in the immediate vicinity of the river for a short distance rises to the height of forty-five feet above its level in the cold season.

The great disproportion in the length of these branches compared with those thrown off to the Sutlej, is very striking, (Art. 20.)

24. From these, as well as from the main chain, proceed a multitude of other ridges, and from these again a third set, and so on till the area becomes covered with this intricate ramification, which but for the assistance derived from observing the courses of the rivers, would almost bid defiance to any analysis. The longest of these, is that which separates the principal branches of the Ganges Proper; the Bhageerettee and the Alecknunda, of the Jumna; the Jumna Proper, and Fouse, and of the Kalee; the Gunjeea, and the Ramgunga. These vary from fifty to 100 miles in length. It would be useless to enumerate the others, especially as they have no distinctive appellations. Nor would the enumeration add any clearness to our idea of the aspect of the country. Suffice it to say, that as they descend in the scale of subordination, they become shorter, and diminish in elevation.[15]

25. All the passes leading into the country of Oondes, are situated in the main chain, it being indeed the only one, as will be evident from the foregoing description, necessary to be traversed between the Dooab and valley of the Sutlej, unless for the convenience of a better road, or more regular supplies. These passes have all, with the exception of three, been visited, and their height above the sea determined, excepting the main pass, of which though supposed to be the highest, it is to be regretted Mr. Tate, the Surveyor, who visited it has left us no measurement. The higher points of the chain are not so well ascertained in all their details, owing partly to their not being visible, and partly to an idea which has prevailed of their great inferiority to the southern peaks, or those included within the Gangetic basin, and consequently ramifications from this chain.

26. It appears however to be sufficiently established, that from latitude 31° 23′, longitude 77° 50′, the elevation of this chain is considerable, being with the exception of a few passes, clothed in the livery of snow all the year round. Its tendency to fall off in that direction is evinced by the gradually decreasing height of the passes, and from the latter point to its termination, little snow is seen, excepting during the winter months. In latitude 30° 35′, longitude 17′, the 77° elevations of what

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[15] This is to be understood, however, only in a general sense, as in many instances the subordinate ridge rises to a greater elevation than that from which it ramifies.

may be called one of its passes is only 2,500 feet. A little beyond this it is lost in the plain country.

27. The following Table of heights contains every point measured in this chain, and the accompanying section embodies the particulars. I have included the names of a few passes, which though not measured, appeared worthy of notice, either as forming frequented points of communication with Oondes, or as presenting unusual difficulties to the few venturous mountaineers who have attempted them :—

Table of the Elevations of the Principal Peaks and Passes of the Indo-Gangetic Chain.

Peak or Pass.	Elevation.	Remarks.
	Feet above Sea.	
Pass to Tuklakot, ...	17,598	This Pass is on the N. E. corner of the Mountain Tract, and leads to Tuklakot, a Chinese or Thibetan factory.
Koontas Peak, No. 2, ...	20,992	
Koontas Peak, No. 1, ...	22,441	
Labong Pass, ...	18,870	
Danna Pass (at least,)	18,000	Not measured — These are two of the most frequented, the first is easy, the other difficult.
Jowahir Pass (at least,)	17,000	Ditto, ...
Neetee Pass, ...	16,814	....
Mane Pass (said to be,)	18,000	Visited, but not measured.
Neelung Pass (probably,)......	16,000	Is said to be very easy of access.
The Cone (Snowy Peak,)......	21,178	These Peaks are visible from the Plains, they give rise on the Southern side to the Tonse.
No. 39, vide As. Res., 14 vol.	19,481	
L. Ditto, ...	19,512	
The Needle, ...	19,064	
Goonass Pass, ...	15,459	A good deal of snow in Sept.
Borando Pass, ...	15,000	Much snow in June.
j (Snowy Peak, vide as above,)	17,425	
i Ditto, ...	17,331	
h Ditto, ...	17,337	
g Ditto, ...	17,035	
Shatool Pass (at least,)	15,600	A very difficult Pass.
d	17,174	
C	16,982	
a	17,044	
Pass below Bagee Fort, ...	9,039	The range has here a S. W. direction.
Pass below Bagee Fort, ...	9,039	
Whartoo Peak, ...	10,673	
Nagkunda Pass, ...	9,000	
Theog Fort, ...	7,926	

Peak or Pass.	Elevation.	Remarks.
	Feet above Sea.	
Mahasoo Temple, ...	9,265	The Camp was 8,965 feet, temple 300 more.
Juke Peak, ...	8,120	
Tarba, ...	5,000	
Kimdera Pass, ...	4,989	
Kol Peak, ...	7,612	
Ujmergurh, ...	4,000	
Bhoora Peak, ...	6,439	
Suran Village, ...	5,500	
Bonytee Debee,...	5,120	
Jytuk Fort, ...	4,854	
Gutasun Debee,...	2,500	Not measured.
Sandstone Hills, ...	3,000	Ditto.
Foot of Hills, ...	1,500	Ditto.

28. A geologist of some eminence, and remarkable for the soundness of his views says, that " writers have erroneously confounded the line of greatest elevation with a chain of water-heads." If we take a survey of the present tract, we shall every where see this opinion confirmed. The range above described, is that which separates the two river systems of the Ganges and the Indus, the principal drains on the side of India from the central plateau. But it is by no means the highest ground, for it is within these basins, and not on their common boundary, that are found disposed those elevated peaks, the real height of which has so long formed a subject of discussion,[16] and from which, as considered the highest summits of the globe, this tract derives one of its principal sources of interest.

29. The term Himmala, generally applied to these peaks, means snowy, so that it is rather descriptive of a broad zone or belt, than of a series of peaks as distinguished from the lower ridges in their immediate vicinity. They have been called a chain, yet no term is less descriptive of the manner in which they are arranged; neither are they a

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[16] It is a curious fact in the history of science the extreme slowness and even unwillingness with which this result has been admitted. Theoretical considerations founded on an experiment in an air pump were held to be sufficient grounds for doubting of our Indian observers. "Jurare in verbo magistri" was the order of the day, and the authority of a name was considered sufficient to justify doubts of results which should have been judged of on their own merits alone. The infallibility of their own dogmas was never even questioned.

series of groups,[17] but rather of transverse ridges (at least within the basin of the Ganges,) which ramify from the Indo-Gangetic chain, over which they yet tower several thousand feet.

30. A line or plane connecting their summits will represent that of greatest elevation. It is evident from Art. 17, that it must cross the Indo-Gangetic chain. It is nearly certain, that in like manner the highest summits of the next portion of the great circular barrier are to be found within the basin of the Indus, and the line continued still farther would doubtless cross the separating chain of the Oxus.[18] Whether this arrangement holds all round, or how far; what is the elevation of this line in every part of its course; of these points, and of many others equally interesting, we are entirely ignorant.[19]

31. But we do know, that from the Hindoo Koh, or Snowy Mountains of Cabul, to the peaks visible from Patna, this line or plane never sinks for any distance below 21,000 feet. Lieutenant Macartney measured one of the former, and found the height 20,493 feet;[20] and in 1815, when with my corps on the Goruckpore and Betwah frontiers, I determined

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[17] On design communement toutes les elevations de terrain, pour peu qu'ils se prolongent, sous le nom general de chaines. Mais il est certain que les montagnes forment plus souvent des groupes que des chaines. Mais les chaines les plus apparentes ne sont souvent que de Lignes de groupes "Malte Brunn Precis de la Geographie," tom. 2, p. 160.

[18] It has been thought otherwise: the Himmalaya have been supposed to find their continuation through Persia, and the chains of Taurus and Caucasus as far as the Caspian Sea. The point may, however, easily be settled, for it appears from Captain Christie's Journal, that there is no snow on the mountains in the neighbourhood of Herat, and it is known from the Ayeen Akberry, that the journey from Bokhara is unattended with difficulty. It is therefore evident, that the Himmalaya, as such, have no continuation in this quarter. But it may be said, and with truth, that the phenomenon of snow is no test of the identity of a chain or ridge of mountains. The Himmalaya, however, is no chain, as I have already shewn, and when we speak of these peaks as constituting a series, it is either as snow-clad summits, or as the highest in their immediate neighbourhood. Considered in either of these lights, their continuation must be sought in the Beloor Tag, and that these are situated within the basin of the Oxus, admits of little doubt. Lieutenant Macartney appears to have been puzzled with regard to this point, but this was owing to the mistake he fell into regarding the course of the Indus. He at once decides against the common opinion. Vide also Rees' Cyclopædia. Art. Altai Belur.

[19] The papers of Mr. Moorcroft and Mr. Trebeck, should they ever be recovered, will doubtless supply many interesting particulars on this subject, and it would be extremely curious to compare their results with what is here hypothetically stated.

[20] So in the account of Cabul, but from the data given, allowing one-tenth for refraction, I find 19,470; doubtless the place of observation is elevated 1,000 feet or more above the sea.

one of the latter to have an elevation of 27,000 feet.[21] Those who have travelled through Oude, within a sufficient distance of the mountain tract, know that the series continues in all that line without any such inferiority, at least as the eye can detect. This is a presumption, if it be no more.[22]

32. The fact, that in a line of 500 miles two summits are found exceeding five miles in perpendicular height, not isolated, but connected to appearance by a regular series of peaks of very little inferior elevation, is alone calculated to give us a lively idea of the enormous magnitude of this mountain zone. It is almost certain, that if we confine ourselves to 21,000 feet, we may find a connected line of such peaks extending through a distance of 1,000 miles. When I say connected, I mean without any apparent breaks, because as already noticed of those within the basin of the Ganges, it is probable that they are not connected in reality; except through the line of water-heads from which they ramify.

33. But, it may be asked, how shall we be certain that this is really the line of greatest elevation, and that is on this side the highest peaks are within the river districts, and not on their boundary; may they not be so likewise on the other side, and consequently there be found in the basin of the Indus, as suggested by M. Humboldt, still loftier summits than those which distinguish that of the Ganges?

34. To this it may be answered, first, that as we have already seen this line of greatest elevation is undoubtedly prolonged into the basin of

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[21] This is the peak mentioned by Mr. Colebrooke, (As. Res.) under the name of Dhawala-giri, or the White Mountain. Captain Webb, whose measurement he reports, found nearly the same result. Captain Blake also, when employed as Surveyor on the Goruckpore frontier, found the same height nearly. I consider my measurement as less exceptionable than either of these, for the following reasons:—

(1.) The position of the peak depends on a traingulation established from a base of 1,142 feet measured with a chain, and not from the protraction of the route, the angles being taken by an excellent sextant of Berges. (2.) The angle of elevation was taken repeatedly, and at different seasons, by reflection from mercury with the same sextant. (3.) A much nearer approach to the peak was made one of the stations, being distant only seventy miles, whereas the nearest of theirs was 120 miles.

[22] It would be very desirable to have the positions and elevations of the principal summits along our frontier fixed with tolerable correctness Such a task would not be either difficult or tedious, provided the attention were confined to those points alone. It would form the very best foundation for a correct map of India, for these peaks once fixed, every place from whence they are visible, may be settled with equal precision, and thus afford means of correcting the Easting or Westing of our protractions, which is the great desideratum. This subject has been noticed by Major Hodgson in the paper in 14th vol. A. S. Res.

the Indus, and most probably into that of the Oxus also, that in some part of this line there may be peaks higher than those in the Gangetic basin is possible, nor can we assign any reason, why it should be improbable. But that there is a higher chain, or series of peaks, beyond the Sutlej, parallel to that which we are considering, is an opinion which is supported by no probabilities whatever.

35. Undoubtedly the subject is even yet involved in some obscurity, which cannot be fully cleared up till all the particulars in that quarter become known. The only direct evidence which we possess on the subject is unfavorable to this conclusion. Mr. Moorcroft, who crossed, and Captain Webb, who visited the Neetee Pass, are both silent as to the existence of such loftier peaks to the N. or N. E. In my journey to lay down the course of the Sutlej I found that after passing this line, all the loftier peaks appeared to the Southward, while those to the North were of a totally different character, rounded summits, almost free from snow, and evidently of less height. In like manner in ascending the height above Shipkee, (16,000 feet), the peaks to the N. E., East, and S. E., were of this character, while to the S. and S. W. appeared those of the true Himmalaya aspect.[24] Nor does Captain Webb, in his visit to the head of the Kalapanee river, notice any high peaks as being visible to the N. or N. E., though he was then not twenty miles from the lake Mansuror.

36. We are justified then, by all that we know of this elevated tract, in considering it as unconnected altogether with the disposition of the water-heads. Nor can any principle of arrangement be traced, which will allow of our proceeding one step beyond that point, at which our positive knowledge of the subject terminates. We may, if we choose, guess, that beyond this, another line still higher may be found, and we may even add a third, still more lofty, but we must be contented to have these conclusions considered as mere guesses too, unsupported by analogy, and having no claim whatever to be received even as probable.

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[23] Further reasons will appear for doubting the existence of a series of loftier summits to the North, when we come to the geological details. Strange that Europe should have been so slow to acknowledge the actual height of the Himmalaya; still stranger, that being unable any longer to deny the accuracy of the measurement, a higher range must be supposed to the North of it, so that it may still be averred, they are not the highest.

[24] Vide *Asiatic Society's Researches*, Vol. 15.

37. It should be noticed, however, that the term line is incorrectly used, or at least with great latitude, and even substituting that of plane, it is still necessary to bear in mind, that its direction, whether as referred to a great circle, or the loxodromic curve, is by no means uniform, or even regular in its deviations; unless indeed we regard it as of considerable breadth, and in that case its surface would be very irregularly studded with peaks. In this way we may certainly affirm, that it is parallel to the common boundary of mountain and plain land. In fact, it is impossible to contemplate such masses disposed along such a distance without feeling convinced, that there is some connection between the greatness of their elevation, and the original formation of the mountain systems in which they are found. The parallelism becomes more obvious when we consider a more extended tract.

38. The following is a Table of all the results hitherto measured, distinguishing also the river basins within which they are situated :—

		Captain Webb.		Major Hodgson.		
No.	Designation or Names.	No.	Elevation.	Letter.	Elevation.	River Basin.
		27	20,923			...
		26	21,045			...
		25	22,277			...
		24	22,238			...
5		23	22,727			...
		22	19,497			...
		21	19,099			...
		20	20,407			...
		19	22,635			...
10		18	21,439			...
		17	19,153			...
		16	17,994			...
		15	22,419			...
		14	25,669	A No. 2,	25,749	...
15		13	22,313			...
		12	23,263	A No. 1,	23,531	...
		11	20,686			...
		9	21,311			...
		,,	...	A No. 3,	23,317	...
		8	23,164	B.	23,441	...
		7	22,578			...
		6	22,498			...
		5	19,106			...
		4	21,611	U.	21,612	...
		3	22,840	D.	23,062	...
		"	...	O.	19,928	

No.	Designation or Names.	Captain Webb. No.	Captain Webb. Elevation.	Major Hodgson. Letter.	Major Hodgson. Elevation.	River Basin.
						...
		3	19,938	Q. C.	19,530	...
		,,	...	C.	21,940	...
		2	22,058			...
		1	22,345	M.	22,792	...
	St. Patrick,............	,,	...		22,798	...
	St. George,............	,,	...		22,634	...
		,,	...	F. C.	21,772	...
	The Pyramid,.........	,,	...		21,379	...
35		,,	...	F.	21,964	...
	Sree Kanta, ...	,,	...	G.	20,296	...
	Rudra Humdah, ...	,,	...		22,390	...
	Serga Raur, ...	,,	...		22,906	...
	Bunder Pooch, ...	,,	...	E.	20,916	...
40	Another summit, ...	,,	...	E.	20,122	...
	Shippure, ...	,,	...		18,681	...
		,,	...	C.	21,155	...
		,,	...	H.	20,668	...
		,,	...		20,501	...
45	Peak visible from Jhala, ...	,,	...		18,795	... ...
	Ditto Twara, ...	,,	...		19,352	...
	The Cone, ...	,,	...		21,178	...
	Raldung,................	,,	...		21,411	...
	Rishee Gungtermy,	,,	...		21,389	...
50	Poorkyol, ...	,,	...		22,700	...

39. In judging of the comparative direction of these summits and those of the Andes, it is not sufficient to be told that the highest of the former overtops Chimborazo, the principal summit of the latter, by nearly one mile of perpendicular altitude; for this single fact, great as is the difference which it implies, falls short of giving a competent idea of the subject. Let us take the highest summits of the Cordilleras measured by Humboldt, and those of the Andes of Peru by Condamine, and others. Although not the same chain, they are situated on the line of greatest elevation, and in both these particulars, they correspond with the Himmalaya. According to Myers, they are as follows :—

Chimborazo, ...	21,441
Desea Cassada, ...	19,570
Cayambe Area, ...	19,336
Cotopaxi, ...	18,891 or 19,155 according to others.
Antisana, ...	19,149

Popocatepetl, ...	17,716 or 17,734
Chillatepetl, ...	17,371
Illinissa, ...	17,238

From this list it would appear, that there is but one summit elevated more than 20,000 feet, and only five which exceed 18,000.

40. Of the fifty-one measured peaks of which we have given a table, there are twenty-eight as high, or higher than Chimborazo, and there are forty-four as high, or higher than Desea Cassada, the second summit of America. Popocatepetl, the sixth in order, is overtopped by not less than 100 summits within the limited tract we are considering; many of the passes even (which are the lowest points) in the Indo-Gangetic range, (which as I have before stated is not the highest ground,) exceed in elevation the sixth summit of America. These facts may perhaps give a more correct idea of the great difference which exists between these two tracts, the loftiest on the globe, and the most remarkable in every point of view. If the rivers of America (and even this is doubtful) exceed in volume and length those of the Old World, at least the mountains must yield.*

41. The great elevation of these peaks is scarcely more striking than is the depth of the vallies or hollows which separate them, and which are always the beds of the rivers. Thus the Poorkyool Peak towers to a height of 22,700 feet, while its base is washed at a horizontal distance of five miles by the waters of the Sutlej; the bed of which river has here only an elevation of 9,500 feet. The difference is 13,200 feet in five miles. In like manner the difference of elevation from the summit of the Kuldung Peak to the Sutlej, in a distance of five and half miles, is 14,711 feet. Of the Soommeeroo Peak to the Mundaknee, distant four miles, 11,000; of a peak (No. 17, Captain Webb's list) to the Gurjeia, distant two miles, 12,370; of the Jowahir Peak to the Goree, distant eleven miles, 15,749. These vallies are far beyond any thing that is to be seen in the Andes.[25]

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[25] Although the Andes have no river vallies comparable in depth with these, yet there are some chasms, as they should rather be called, which taking together their

* Our author was, it will be remembered, writing before Mr. Pentland's measurements of Sorato 25,400, Illimani 24,350, and Descabezado 21,100 feet.—H. P.

42. The above list, if it were thought necessary, might be much increased. It is very true that they are nearly consequences of the manner in which these peaks are disposed, but it is this very disposition which is so singular, and worthy of remark. It is the extraordinary elevation above the ground on which they immediately stand that is so striking to a traveller within these mountains, because it is at once taken in by the eye, and requires no consideration to aid the effect. It is different with summits placed on an elevated table land, where we are continually obliged to remember the height of the latter, and even with this assistance, they fail to astonish and confound the imagination in the degree that a nearer view of the Himmalaya is found to do.[26]

43. I must remark here, that the instances given above, belong to a fact which is general throughout these mountains, and which as it is very striking, and seems capable of throwing some light on the mode of their origin, ought not to be passed over. It is this: wherever the separating ridge of two river vallies approaches the banks of one of them, there is its highest point; and where it holds a middle course for any distance, it is there found to be lowest; equally throughout the higher and the lower mountains will this remark be found to hold good, nor am I aware of a single exception to it.

44. But it is chiefly as snow-clad summits on the border of the Torrid Zone that these mountains have attracted attention. It is probable that but for this phenomenon, their elevation would have remained to this day a desideratum. To the inhabitant of the plains, who being under a summer temperature of nearly 100°, is exhausted with heat, it is certainly a phenomenon full of wonder. To those too who consider the heat to be in the sun's rays, (the bulk of common observers,) the wonder must be greatly increased, as the summit of the mountain is nearer by five miles to the sun than the plains at its foot; even the scientific observer cannot entirely divest himself of that feeling of admiration, which the sight of any thing so unusual to his common ex-

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depth and extreme narrowness, are very striking. M. Humboldt mentions several of these, one of which though it be not 3,000 feet across, is yet upwards of 4,000 feet deep. Captain Hall too, notices the depth and steepness of the ravines or *quebrados of Chili.*

[26] But as these mountains are elevated on the high plain of Quito, which is elevated farther above the sea than the top of the Pyrenees, and constitutes more than one-third of the computed height, they are inferior in actual elevation to Mont Blanc. See Rees' Cyclopædia, Art. Andes.

perience, however agreeable to the deductions of science, must necessarily excite.

45. It is this phenomenon which has always occasioned them to be objects of attention, and it is singular enough that it is also on erroneous considerations connected with this phenomenon that the doubts of their superior elevation have been founded. I shall include under the remarks on climate, what I have to offer on the theory of the subject and the arrangement of the Isothermal bands. I shall here confine myself to a statement of a few of the most interesting particulars connected with the occurrence of this phenomenon.

46. It will be readily understood, that according to the season of the year, the zone which is marked by snow will be of more or less extent. If we take our estimate in that month in which the quantity is a minimum, and after which there falls more than melts, we may satisfy ourselves that a belt of ten to fourteen miles in breadth is distinguished by this phenomenon. It is not meant that snow lies in every point of this tract, but merely that within it will be found summits bearing snow all the year round. The minimum elevation of this snow-bearing tract is nearly in round numbers 15,000 feet, which may therefore be taken as the elevation in this latitude of the curve of perpetual congelation. There are, however, many spots of greater elevation perfectly bare of snow, this fact is, however, connected with a different arrangement of the seasons, and will be noticed in the section on climate. At all elevations exceeding the above, where snow lies, it is generally quite firm, except immediately after a fresh fall.

47. Many parts of this zone have such a disposition of the surface that it is quite impossible that any part of the snow which falls should ever be lost, except by melting, or by evaporation. The loss from the former cause must be very little at elevations much exceeding 15,000 feet. At 18,000 it must nearly cease altogether. The loss from evaporation will doubtless be considerable under so rare an atmosphere, still however we may safely conclude, that a surplus is left every year to accumulate. In favorable situations, we may imagine then the depth of these snows to be very great. In fact, we may suppose a case, without hazarding any improbability, where they have been yearly increasing since the origin of these mountains. Such supposition is calculated to give us a stupendous idea of the magnitude of these deposits.

48. We have seen that the line of greatest elevation intersects instead of bounding the river districts (Art 30). On each side of this line to the north as well as to the south the peaks diminish in elevation, yet not equally. To the southward the decrease is more rapid, and is accompanied by an anomaly which is sufficiently striking. The diminution of elevation, which is pretty regular till near the boundary of the plains and mountain land, is there suddenly interrupted. The peaks shoot up considerably above the mean elevation of those immediately north of them, and as suddenly sink into the plains; so, that if we divide the country, south of the line of greatest elevation, into five parallel zones, the fifth will be as high as the third, while the fourth will be found considerably lower than either.

49. Some of the most remarkable instances of this fact are the following: The Ghagur, which rises above Bhumowree, has one of the lowest of its passes, in a road distance of fifteen miles, elevated 7,121 feet above the sea. Another instance may be seen in the high range south of Sreenugger. A third in the Soorkunda range, as connecting that peak with Bhudraj. The latter overlooks the Doon, the former is but fifteen miles from Dhera, situated in the centre nearly of the valley, yet their altitudes are respectively 7,510 and 9,271 above the sea. The Jamoo Peak is another example. The Bhoora Peak a still more remarkable one. The latter elevated 6,439 feet above the sea, appears actually to overhang the lower hills which form the transition from its foot to the plain country. Many more instances might be adduced, were it necessary to multiply the examples. If a surface be supposed, such as to represent everywhere the mean elevation, that surface will not be inclined regularly plane, but will have a considerable curvature.

50. Another curious feature in the physical structure of this mountain tract is the situation of the high peak called the Choor. Its summit is elevated 12,149 feet above the sea, and if it be made the centre of a circle of sixty miles diameter, the circumference will on one side just fall on the common boundary of plain and mountain land, while within this circle, no point will be found within 15,00 feet of this height, and even those mountains which approach this limit, are, strictly speaking, part of the chain of which the Choor is the highest peak. From whatever quarter it be approached, it will be seen from very great distances standing up above the surrounding ridges like a huge beacon,

at once remarkable for its superior elevation, as for its peculiarity of form. The investigation of its geological structure must, for these reasons, be found very interesting.

51. Of the several rivers and streams by which the drainage of the Gangetic basin is effected, some have their origin from the Indo-Gangetic chain, that is, from the farthest side of the snowy zone, others spring from various points within that zone, or from its southern face, and a third class from the lower mountains where snow only rests a few months in the year. To the first class belong the principal sources of the Kalee and Ganges Proper, the Kalee, the Dhoalee, and the Sooree, branches of the former. The Dhoalee, the Bishun Gunga, and the Jahnuvi of the latter. To the second class belong the subordinate branches of these two rivers, and the principal ones of the Jumna, that is to say, the Ram-Gunga and Surjoo (Kalee); the Pindar, Mundaknee, Kalee, Bhillung and Bhageerethee, (Ganges); and the Beraee Gunga, Jumna, Soopin, Roopur, Pubbur, and Andryttee (Jumna). To the third class, which is the most numerous, belong all the other branches of these rivers, but six of them only require mention, as being at all remarkable. Of these, three pour their waters into the principal stream within the mountains. These are the Luddeea which joins the Kalee, the Nyar which belongs to the Ganges, and the Girree a branch of the Jumna. The other three have a considerable course within the plains. The Cossillah and Ramgunga join a little below Mooradabad, and with the united stream, eventually contribute to swell the waters of the Ganges. The Murkunda, the third of these, loses itself, it is said, in the sands of the Desert.

52. Amidst so many branches, it may seem difficult to fix on that which is entitled to the pre-eminence, and to be considered as the principal source of the river. If, however, we recollect that the most distant source must be the most elevated, and must have contributed the largest supplies, we shall have a principle of selection, easily applied, and which leads to some curious results. In particular, it will appear, that the Soopin is the parent stream of the Jumna, and its source must therefore be the principal one. Of the Ganges, neither the Bhageerettee or the Dhoallee, so long considered rival sources, is entitled to that distinction. In reality, the Jahnuvi is the most distantly derived of all its branches, and must therefore be admitted to be the real source of this great river. Singularly enough too, of all the mountain rivers, this is the only one

that has not been traced up to its origin, owing to its being within the limits of Chinese authority; the conclusion then is inevitable, that however we may pique ourselves on having visited and fixed the sources of the Ganges, the position of its most elevated and distant source is still a desideratum. Nor has the first beginning of this mighty river been yet beheld by European eye.

53. The following Table gives the particulars from which the foregoing conclusions have been drawn. It exhibits the distance, in miles measured along the river's course, of each source, taking as the point of departure, the place where the river enters the plains.

Name of Branch.	*Dist. of Source.*	*River Basin.*
Kalee,	180	Kalee.
Dhoalee,	180	
Gungeea,	165	
Ramgunga,	127	
Surjoo,	143	
Dhaolee,	225	Ganges.
Bishunnunga,	202	Ganges.
Jahnuvi,	233	
Pindur,	203	
Mundaknee,	150	
Kalee,	143	
Bhaeergettee,	203	
Bhillung,	150	
Jumna,	123	Jumna.
Bheeraee Gunga,	124	
Tonse (Soopin),	154	
Pubbur,	150	
Roopur,	143	
Andryttee,	145	
Sutlej,	555	Sutlej.
Cossillah,	100	Kalee.
Ramgunga,	105	
The Ludhee to its confluence,	52	
Nyar,	82	
Girree,	112	

54. The sources of these rivers which spring in, or from, the Snowy Zone, are elevated from 10 to 17,000 feet, the first being that of the Jumna, the latter of the Sutluj, the two extremes. There is evidently some connection between the length of a river course and the elevation of its source. I find from a comparison of those which flow in the same direction, and which may be consequently supposed to have the same declivity, that the height of the source above any given point is as the square root of the distance from that point. Thus the Jumna, Kalee, and Bhagerettee are respectively elevated above the points where they enter the plains, 9,573 feet, 10,593 feet, and 12,776 feet, which results are as the numbers 10, 11, 6, 12, 9. Their distances from those points are 123, 143, and 203 miles, the square roots of which are as the numbers 10, 11, 1, 13, 3, differing by less than unity from the preceding.[27] The Sutlej will not bear a comparison with these, because its course *is* in a different direction, and has not consequently the same declivity. In the direction of its course, its great length, and the little aid it derives from accessory streams, it forms a strong contrast to all the other mountain rivers.

55. A feature common to all the water-heads that belong to the Snowy Zone, is their situation always in a comparatively open and level spot, with an accumulation of snow resting against the base of some lofty peak, from which the embryo stream derives its first supplies. According to the season of the year, the snow-bed will be of greater or less magnitude and depth. During many months, the place will be deep in snow, and unapproachable. After the snow begins to melt, a constant moisture is kept up for many months, while in the fine season again, vegetation goes on luxuriantly. The consequence is, the formation of a thick coating of peat, which is invariably found at all elevations, having a temperature such as to ensure during several months the slow and gradual melting of the accumulations of snow that occur during the winter. From 11,500 to 13,000 feet, according to locality, may be considered as the height at which peat will be found. It is always however

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[27] This law is not applicable to different parts of the same river's course, and yet it gives very near approximations in the case applied. Thus if from the distance in miles of any source from the *debouche* the square root be subtracted, and multiplied by 882, the product is the height in feet above the *debouche*. This would give 12,221 feet as the height of the source of the Tonse. The result by the temperature of boiling water was 12,781

in greatest quantity, and of a better quality in such spots as above described; that is, in hollows; because the supply of water is more constant, and equally gradual.

56. The discharge of the four great rivers at their entrance into the plains, has not been directly measured, except in the case of the Jumna. It appears however reasonable to infer, that the discharge will be proportionate to the extent of country drained; in other words, to the total length of course made up by adding the several branches of the river together. This rule I found to hold in the case of the Tonse and the Jumna, the discharges of which I measured in 1819. Thus, their total lengths of course were as the numbers 1, 2, 6. Their discharges as the numbers 1, 2, 8. In adopting then this expression for the valuation of the discharge, and taking the Jumna at 4,000 cubic feet in a second, (which is within a few feet of the result I obtained in March 1819,) we shall have the following results:—

	C. F. in one second.
Discharge of the Kalee at Bishin Deo, ...	4,800
Jumna at Badshahee Mahal, ...	4,000
Ganges at Hurdwar, ...	7,000
Sutlej at Ropur, ...	8,100

We see here that, notwithstanding the far greater length of course which distinguishes the Sutlej, (more than double,) it does not greatly exceed the Ganges in discharge. This is owing to the comparative narrowness of its basin, and its want of great branches.

57. Although there are no great vallies in the interior, (Art. 15,) yet along the common boundary of mountain and plain land, on a line parallel to that of greatest elevation, there are seen a series of small vallies, which are however unconnected with each other, and sometimes separated by a long interval. These vallies are always marked by the *debouche* of some great river, and there is doubtless some connection, in the origin, between them and the river systems. Although there is not a valley to every river, yet they are found along the whole tract at intervals, as far as Patna on one side, and beyond Cashmeer on the other. The occurrence of these vallies through such a distance, and so symmetrically situated, favors the idea which would attribute a community of origin, or at least connection in structure, to the whole of this tract of Alpine land.

58. Those belonging to the tract to which the present description is confined, are the Pinjore Doon or valley, the *debouche* of the Guggur; the Kyarda Doon, the *debouche* of the Jumna and Ganges; and the Pattee Doon, the *debouche* of the Ramgunga. They are all bounded, or separated from the plains by a low chain of hills, which is also a line of water-heads, and contains the sources of those streams which, engulphed in the tract immediately at their feet, afterwards spring up in the Teraee, occasioning the humidity of soil which is so characteristic of that tract.

59. The Dehra Doon, which is the principal of these vallies in extent, and probably the only one demanding a detailed description, is from the Jumna to the Ganges about forty-five miles in length. Its breadth is variable, being in some places scarcely ten, in others fifteen miles.[28] The surface is undulated, and has, in particular directions, a strong declivity.[29] Many banks or steps occur, varying in height from one to thirty feet. These generally follow the course of the streams, one on each side; appearing to have the same relation to them which the Kadur, or marshy lands of the plains, have to the rivers there. Their distance, or the breadth of the channel they mark, is very considerable even in the case of the smallest stream, and they exhibit the same variations in arrangement which the river banks in the plains do.[30] There is little question but that they have once been the beds of running water, however incapable the present streams may appear of filling them even in their highest floods.

60. The drainage of this valley is effected entirely by the two rivers, Asun and Sooswa, which rising within a few hundred yards of each other near the middle of the valley, run in opposite directions, the former to meet the Jumna, the latter to the Ganges. The fall of these rivers is considerable; the elevation of the source of the Asun being 2,148 feet above the sea, and its confluence with the Jumna 1,469 feet, being a fall of 652 feet in little more than twenty miles. The fall of the Sooswa in a course

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[28] The admirable new road made by the Honorable Mr. Shore, leading from the Keeree Pass through Dehia to Rajpoor, at the immediate foot of the northern hills, measures, I think, fifteen miles.

[29] The base which I measured in the Doon in 1819, had a difference of level of 300 feet between its two extremities. Its length was about four miles.

[30] That is to say, a steep bank is always opposed to a low shelving one. When both are alike, neither are observed to be remarkably steep or shelving.

of about the same distance is 948 feet, its confluence with the Ganges having but an elevation of 1,200 feet above the sea. The course of these rivers is parallel to the direction of the valley, and very near the South-western boundary, so that their supplies are almost entirely drawn from the Northern barrier of mountains. The numerous feeders which spring from these, all flow across the valley, shewing, that there is a considerable declivity also in that direction. In fact it is found, that from Rajpoor at the foot of the hills, the fall is regular to within three miles of the Kheree Pass, and amounts to 1,300 feet. Thence to the Kheree Pass is a rise of 618 feet. This line is that of the new road; it passes through Dhera cantonment, and very nearly, if not exactly, separates the two basins.

61. The range of hills which bounds the Doon to the Southward, is of peculiar aspect, and presents some very interesting appearances. The total depth of this belt in the widest part is about ten miles. The range is not intersected by vallies with sloping sides, as the great mountain tract is, but by the beds of torrents which are generally bounded on each side by perpendicular precipices, sometimes 500 feet in height. The ridges are extremely narrow, so as to bid defiance to any examination of them, except such as can be effected in the beds of these torrents. The line of water-heads which separates the streams which seek the Doon from those flowing plainward, does not hold a regular course, as compared with the general tendency of the mountain belt, being sometimes at the border of it, as at the Lal Durwaza Pass, sometimes nearly in the middle, as at the Timlee Pass. The former has been stated to have an elevation of 2,935 feet, the latter is only 2,339. The peaks do not rise more than 600 feet above these levels, so that 3,000 to 3,500 may be taken as their general height.

62. The appearance of this valley is highly picturesque, particularly in the neighbourhood of Dehra. The intermixture of cultivation, in which the fields are defined by hedges, with patches of green, over which are scattered fine groves of trees, the undulation of the surface, and its intersection by numerous streams, are features that might almost remind one of the scenery of England. The proximity of lofty mountains occasionally clothed with forests, in which the pine, oak, and walnut are conspicuous, gives a variety to the landscape, which viewed at a favorable season, is picturesque and beautiful in a high degree. The soil is gravelly,

yet to judge from the cultivation, far from poor; and though at present thinly peopled, and but partially cultivated, was once otherwise. The land revenue had dwindled down to 10,000 rupees, when it came into our possession. It is said to have yielded 80,000 in the time of the Rajahs of Gurhwal. Under the fostering care of the British Government, it will not be long in recovering its former prosperity. The principal difficulty appears to be the want of water for irrigation, yet this is an objection easily remedied, for with so varied a surface, and so many streams, water might at a trifling expense be conducted in almost any direction. Capitalists are wanting to undertake this and other improvements.

63. The Pinjore Valley is the next in point of extent. It has in parts a breadth of perhaps six miles, and its length may be estimated at about thirty. It is tolerably even in its surface, and the hills which bound it to the Southward, are of much less depth and of less elevation than these of the Dehra Valley, at its South-east angle, in the *debouche* of the Gaggur, a river which is lost in the sands of the Desert. From Tuxal the streams run in one direction towards the Guggur, in the other towards the Plassia river, a feeder of the Sutlej. Pinjore, the principal village or town, with a fort, of masonry, is elevated 1,819 feet above the Seebar, which is at the foot of the mountain, and near the separating ground of the two river basins is 2,402 feet above the sea. Munsie Debee, a temple in the plains, just without the Doon, is 1,263 feet. From these results an idea may be formed of its declivities. It is not so well cultivated as the Dehra Doon, though it appears to possess equal capabilities.

64. The Kyarda Doon is of less extent than the last, having in its widest part but a breadth of six miles, and in length being but twenty-five miles. This estimate of its length supposes it to terminate at the Pass of Ghatusun Debee, where it narrows so much as to be scarcely entitled to the name of a valley. From Ghatusun, the elevation of which is 2,500 feet, the streams flow eastward to the Jumna. To the westward flows the Markunda, which enters the plains under Nahun Siki, on the Ghuggur. It loses itself in the sands of the Desert, so that we cannot refer it either to the Sutlej or the Jumna basin. I have however considered it to belong to the former, and Ghatusun I suppose the lowest point of the Indo-Gangetic chain. Of the Pattle Doon, I cannot give any account, as I have never visited it.

65. About thirty miles north of Almorah, or a little west of north, there is a small tract of rather greater extent than those to be hereafter noticed, and more uniformly level in surface. It is watered by the Gaomuttee and its several feeders, a river which joins the Surjoo, one of the branches of the Kallee at Bagesur. These feeders are very numerous, and the glens in which they rise being broad, with a level terrain, form by their inosculations with the principal one, the appearance of a considerable tract of open and almost level country. From Koolan to Retora is a distance of ten miles, in all which line the surface appears to have little undulation. The forest is not too thick, and yet from some unexplained cause, the tract is unhealthy in a high degree, so much so, as to be in a great measure neglected, and allowed to run waste. The elevation of Byznoth, a temple of some sanctity on the Gaomuttee, and which may be taken as the lowest point of the valley, is 3,800 feet; the villages are situated chiefly on the lateral ridges which divide the several subordinate glens.

66. In the beds of the different rivers there are, as might be expected, various spots of a limited extent, and of sufficient evenness of surface to be always objects of interest to the cultivator, though from their smallness, scarcely entitled to the denomination of vallies. These spots generally occur in an advanced part of the river's course, and being therefore the lowest places in the mountains, are necessarily the hottest. In general they are fertile, yet are all considered more or less unhealthy, particularly at the breaking up of the rains; and when narrower than usual, so notoriously subject to the *awal,* or jungle fever, as to be entirely neglected ; instances occur in the bed of the Surjoo and Kalee. But where the width is rather greater, or the surrounding mountains not too lofty, they form the most populous, the most productive, and the most beautiful spots within the mountains. The width is seldom more than half a mile, but the length is sometimes considerable.

67. The most remarkable instances of this kind may be seen in the bed of the Sutlej at Soonee and at Dutnuggur; of the Bhagerettee at Teeree; of the Aluknunda at Sreenuggur; at Pannae of the Western Ramgunga along nearly the whole of its course; of the Cossillah for a distance of ten miles; of the Benee Gunga for about the same distance; of the Buspa at Sungla; the Sirjoo at Kubrol, of the Geree Gunga in a great part of its course; and in the Comoulda, one of the principal

feeders of the Jumna: several smaller streams are equally, if not more, remarkable; and in general, similar level, and comparatively open, spots are found at the heads of all the rivers.

68. To this class also belongs the series of petty vallies to be seen in the neighbourhood of Petorah, though not constituting the bed of a river. The largest of them does not exceed perhaps two square miles, but they are in such number, as to render that district one of the most productive, for its extent, in the mountains. They are generally connected by some narrow gorge, so that, in one quarter, a distance of five miles may be travelled in which the surface is almost perfectly even. The appearance of the country, owing to such a number of these local spots, and the consequent insulated situation of many of the peaks, is peculiar to that quarter, and very striking. In the neighbourhood of Dhooara Hath, about twenty miles from Haurel Bagh, a pretty extensive piece of tolerably level ground is to be seen, and similar pieces in the neighbourhood of the small lakes, which are to be seen about ten miles above Bhumowree, on the road to Almorah. With the exceptions here stated, (and their collective sum bears but trifling proportion to the total surface,) all is rugged and difficult, a succession of steep and lofty ridges and deep glens.

69. The lakes mentioned in the preceding article, constitute a feature in the physical description of this tract which should not be forgotten. They are, however, on a very small scale, compared with the grand system of mountains to which they belong. One of them, Bheem Tal, situated about ten miles above Bhumowree, on the Almorah road, is only 3,000 feet in length, by 2,400 in breadth; the depth, however, is said to be very great. It is situated at the lowest point of the valley, about three miles in length, and at some distance from it appears a considerable pool, which is at present connected with it by a running stream, the intermediate ground being marshy, and covered with flags. These circumstances leave no doubt in the mind of the spectator, that the whole of this valley once formed a lake, and it might easily be restored to the dominion of the water, by damming up the outlet, which the present lake has found for itself. The elevation of this spot above the sea is 4,200 feet.

70. About five miles east of Bheem Tal, is another called Nynee Tal, having nearly the same extent. A little beyond this is a third, called Nakoon-ka Tal, and besides this, some others of much less extent.

Within ten miles of Jytuk, near Nahun, is another called Ren Kee Tal. It is in breath about 400 feet, and in length, as measured by the perambulator, one mile and a half. In common with all the others it is said to be of great depth, and to abound with excellent fish. A pool at the head of the Tonse, called Resul Kee Tal, and thought by the mountaineers to be unfathomable, may also be mentioned. As likewise a similar pool at the head of the Dinee river, one of the feeders of the Bhageerettee. The waters of all these are perfectly sweet and tasteless.

71. Along the foot of the mountains extends a tract called Bhabur, which has been always I believe reckoned an integral part of the mountains, politically speaking; it is of considerable elevation, and is farther distinguished by an almost total deficiency of springs or running streams, excepting such as, issuing from the mountains with a large body of water and considerable force, make their way through it without having their waters engulphed.

72. It is bounded to the southward by a line of springs or waterheads, which is also the northern boundary of the tract called the Terrai, one equally distinguished with the former from the southern plain country, but occasionally annexed to it and occasionally to the hills. This tract is remarkable for its moisture, as the other is for its dryness. Water in the driest season, (March 1826,) is never more than thirteen feet from the surface, generally much less. It is intersected by numerous streams, which with the inclination of the surface, affords such facilities for irrigation, as to render the tract, when fully cultivated, highly productive.

73. The Terrai is defined in its southern boundary by a rise or step, which runs parallel to the common boundary of mountain and plain land. This rise is a very singular feature in the aspect of the country, and forcibly impresses the spectator with the idea of some great catastrophe in which water has been the chief agent. The height is variable, and occasionally is as much as thirty feet, sometimes it is sudden or steep; and it is then intersected by ravines, the effect of floods in the rains; sometimes it is gradual, and it is then liable to be mistaken for an undulation of the surface; sometimes it consists of two banks or steps, and occasionally even of three; a similar step or break in the surface is found to accompany the course of each of the rivers after quitting the mountains. In this case, it forms the boundary of what is called the *khadir*, which as may

be understood from what precedes, is a low tract of variable width within which the river has its bed. These appearances correspond exactly to the banks described as accompanying the rivers in the Doon.

74. The Terrai may then be considered as a very shallow valley parallel to the direction of mountain land, and the *khadirs* or low lands of the rivers, as so many transverse vallies communicating with it. This itself is a presumption that the rivers have not formed their *khadirs,* but this is further established by the fact that the *khadir* is widest in the vicinity of the mountains, and diminishes as the river flows southward, till at no great distance it disappears altogether. At Bhogpoor on the Ganges, the *khadir* is of great width, yet in the highest floods in the rains, the river never rises to its level. At Durra Nuggur, the *khadir* is from five to seven miles in width; such a valley could never have been scooped out by the stream which now flows there.

75. The Terrai being thus distinguished by a fall or step, is usually considered very low in comparison with the low country south of it. Such however is not the case, although so strong is the deception in looking at the face of the country, that few people can be persuaded of the truth of the matter. Yet a little reflection would be sufficient, without any thing like measurement, to shew that it is a deception. The streams which take their rise at the foot of the Bhabur all flow southward, with banks of nearly equal height, and currents of considerable force. And from the Bhabur, which is so high as to be visible to the eye, there is no sudden descent to the Terrai, the line of demarcation being traceable only from the presence or absence of the springs, or from geological considerations connected with the nature of the deposits.

76. The preceding will, I hope, give some idea of the physical features of the country I have undertaken to examine, without which the geological description must be in a great measure unintelligible. The two classes of facts are so connected, that it is impossible to separate them; each throws light on the other; and if we wish to trace those general relations which furnish the highest and most interesting discussions in this new science, we must begin by taking a clear, as well as comprehensive, view of the physical aspect and arrangement of the surface.

77. It is my intention to give in the first place the simple geological details as observed, in order that a clear idea may be had of what is ac-

tually known, as distinguished from what may be considered matter of opinion or inference, subjoining an attempt to combine these details into something like a systematic view of the general structure of the tract, adding such inferences and illustrations as have occurred to me in reconsidering the subject. In the geological details, I shall follow out the extent of each rock as yet observed separately, and in the order in which they actually occur, beginning with the highest zone, and descending gradually to the plains.

Section II.

GEOLOGICAL DETAILS.

78. In the zone of the Himmalaya, the only rock which I have yet observed, I mean as covering any extent, that is, as constituting a formation, is gneiss; other rocks are found it is true, but only in the form of veins or beds. Gneiss has been traced from Deao, opposite Muzzoolea near Seran in the western corner of the Survey, by Brooang in the valley of the Buspa, and thence ascending to the Snowy Pass of the same name, leading into the valley of the Pabur. In this line the varying level, (5,500 to 15,000 feet,) leaves no doubt of the great thickness, as well as lateral extent of this formation. It is not, however, every where equally obvious, the coating of debris being often of great thickness and covered with luxuriant vegetation. Frequently the only trace of its occurrence consists in large angular blocks lying on the surface or imbedded in the coat of debris. This may perhaps be considered inconclusive evidence of the existence of this rock as a formation, but the case admits of no other, and the same difficulty meets us at every step in these mountains, and as no fragments or any other traces occur, or any other rock in this tract, with the exceptions I shall presently mention, we shall find a difficulty in saying what rock is found below the surface, if we find it necessary to deny the existence of gneiss.

79. This rock is of the most ordinary character in the greatest number of instances, consisting of quartz, felspar, and mica, and nearly in the usual proportions. It seldom contains any foreign imbedded mineral. The felspar is almost always white, seldom grey, and only

in one instance of limited occurrence have I observed it of reddish hue. The quartz is most commonly white and semi-transparent, occasionally grey; the mica is of all shades, varying from silver white to a deep brownish black; some specimens contain both extremes of colour.

80. There are three distinct types of structure in this gneiss, two of which are well separated, both in appearance and position. The laminar which is often contorted, the granular,[31] in which the laminar structure is often obscure; and what may be termed the glandular. The first two appear to pass into each other, and to be irregularly mixed together, but the third preserves a great uniformity of appearance over a considerable tract. It has really the laminar structure as strongly marked as the first, but it is well distinguished from it by the imbedded lenticular, or round nodules of felspar which it contains, and which give it a most peculiar appearance. The laminæ are bent round these nodules, which have a foliated structure, and are sometimes disposed in two layers; the line of junction, which coincides with the axis of the nodule being so faint as only to be perceptible by the varying reflection of light from the two parts. There is very little doubt but this line of junction coincides with one of the faces of composition of the mineral, but I have not yet established this point to my satisfaction.

81. The dip of this rock appears involved in some obscurity; along this line, at least it presents some anomalies, the explanation of which I have yet to learn. This may be, nay doubtless is, partly owing to the frequent concealment of the rock beneath the coating of debris, leaving us in these cases to form our judgment from the configuration of the mountains, with reference to the sides of slope and precipice. Even this test sometimes fails, either from the great accumulation of debris completely modifying the superficial forms of the rock, or perhaps from the absence of definitely marked stratification. For even occasionally when the rock itself is visible, there occurs doubt as to this point, the fissures being so numerous and variable in direction, as to render it impossible to pronounce which are, and which are not the lines of stratification.

82. From Deao to Kungos, the dip appears to vary between N. and E.,

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[31] By this term it is not meant to designate the granitic structure, but an aggregation of small grains, in which the difference of the felspar and quartz is often difficult to be ascertained.

being often N. E., and this on both sides of the Sutlej, the angle of inclination being about 30°. One measurement gave N. 70° E. But near Nichar, again it appears to be to the West of North, the inclination still much the same, or even less than 30°. A very remarkable rocky precipice occurs opposite this village, traversed by numerous rents and fissures, but nothing can be traced like marks of regular stratification; nor can even a line from the neighbouring strata be fancied to connect with any of them; yet from the appearance of the rock, I have not a doubt but that it is gneiss. Near Keelba, there is a considerable access to the rock, which is a perfect laminar gneiss, yet nothing like the regularity of stratification is observable in it either, the lines running confusedly in every direction.

83. At Woongtoo bridge, the stratification is also very obscure, and the natural divisions of the rock very various in direction, but as the laminar structure, which is, or ought to be, discriminative of gneiss is here often obscure, if not altogether wanting; the rock by many will perhaps be considered a granite. A few miles beyond this bridge, with an interval of distinctly stratified rock, a similar amorphous mass is seen on the right bank of the Sutlej, surmounted by regular strata of gneiss dipping S. W., but presenting that arrangement which has obtained the name of wedge-shaped strata; the upper layers approaching more and more to the perpendicular position. On this side (the left bank) is a similar mass of gneiss, but with an opposite dip, (that is to N. E.), and with the same arrangement, the inclination of the lower strata being inconsiderable, while the superficial are nearly vertical. This appearance struck me very much, coming on me, as it did, after a long and patient examination of the Woongtoo rock.

84. Beyond the irregularly seamed rock noticed as occurring near Keelba, we find a perfectly stratified arrangement continuing from a considerable distance, the dip pretty regularly N. E. and the inclination between 20° and 30°. This is the glandular type noticed article 8. On turning up the Buspa, below the village of Brooang, extensive types of stratification are seen, but with a S. E. dip, and an inclination of about 25°. This dip continues in the ascent to the Pass as long as any thing like stratification can be perceived. But in the last 4,000 feet of ascent, the rocks again put on the shattered and fissured appearance before described, and on the Pass itself, nothing like stratification can be traced, owing to the

intricacy of these seams, and the various directions in which they lie. But of the identity of the rock there can be no doubt, as I examined it along the whole of this line, and collected numerous specimens. It is a gneiss of the most perfect type. The Pass is strewed, as might be expected from the appearance of this rock, with huge angular blocks. I may add, that on the South side, a N. E. dip is again met with, but accompanied by a considerable change in grain, and a thinner laminar structure. This observation was made at an elevation of about 12,000 feet above this; all around, the ridges appeared with the same fissured and shattered aspect, while the river (Pabur) bed is strewed with fragments of every size, leaving no doubt that the rock is gneiss.

85. The only imbedded minerals I have observed in this tract are, 1. mica in tabular crystals, but not well defined, nor otherwise of any particular value, (near Seran); 2. schorl occasionally sparingly disseminated in small prismatic crystals (near Seran); 3. garnets of a lighter colour than usual, small and sparingly interspersed, their figure obscure if not imperfect; 4. quartz of bluish green color in six-sided prisms, occasionally attaining to the size of an inch in diameter, and two or three in length. They are found imbedded in a granite vein near the village of Keelba, but are with difficulty separable from the matrix. The quartz which forms the regular ingredient of this granite is of a light grey colour; 5. it is said that copper and gold were formerly obtained at a spot between Yanee and Keelba on the right bank of the river, but that the workings have been long abandoned.

86. Hornblende rock occurs in beds in the neighbourhoods to Sera, Tanada, and Kemgos. It rarely consists of the pure mineral, most commonly of a mixture of that and felspar. It is sometimes of a schistose structure, sometimes of that which I call the cleaveable. The two types appear to pass into each other by imperceptible gradations; in one case only, near Seran, could I perceive any thing like a transition or passage of the gneiss into this rock, the change in the other instances being sudden, and the contrast marked. These beds are generally of very limited extent, seldom more than a few yards, particularly between Deas and Suran, in which line they are also numerous. Near Tanda, the bed is larger and occupies the whole of the mountain side, forming the ascent to the village. A bed of micaceous schist occurs near Seran, and one of compact quartz rock, forming a precipice of great mag-

nitude. At the confluence of the Buspa, the road lies along the foot of this mass, and is strewed with fragments from it.

87. Granite veins are evidently numerous in the neighbourhood of Wongtoo bridge, for among the fragments that are met with for several miles on each side, we observe a proportion of them to be granite. These fragments often present undeniable evidence of their veinous origin in retaining part of the gneiss which formed the wall of the vein, and it was this circumstance, combined with the low proportion they bear to the fragments of the gneiss, that first suggested the idea of their being derived from that source. But there can be no doubt on this subject, as in the immediate neighbourhood of the bridge, just before descending to the river bed, these veins may be seen in great number intersecting the gneiss, most commonly in a direction from N. E. to S. W., and again in the anomalous rock at the bridge.

88. The granite of these veins is always of a large grain, and is remarkable for the very large proportion of felspar it contains, the mica being comparatively deficient. The felspar is white and foliated, the quartz of a light grey, the mica generally brown. No difference of composition is observable between the middle and the sides of the veins, nor any change in the gneiss in its neighbourhood. The breadth is very various, and equally so the extent. The former is from a few inches to several hundred feet. They occasionally divide, but they cannot be said to ramify, at least not in a remarkable manner.

89. The rock which occurs at the bridge, and which contains the largest of these veins, is something of an anomalous nature, and might be adduced as an instance of that transition between gneiss and granite, which has been so often observed. Some specimens would certainly be considered to belong to the former title, while others might be chosen, which would as certainly be referred to the latter. It has, however, in mineralogical aspect, a strong resemblance to the more well-defined gneiss in its neighbourhood, while it has none whatever to the granite veins. I may add, that its occasional want of a distinctly laminar structure, and the indistinctness of its stratification, are the only obstacle to its being considered identical with the surrounding accurately defined gneiss.[32]

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[32] It has been usual to call anomalous rocks of this description granitic gneiss, but the mere giving it a name affords no new information, nor in any way settles the doubt as to which type of rocks it should be geologically referred.

However this may be, I ought to notice that it is of limited extent in this direction, certainly not exceeding a square of 500 yards.

90. The band of gneiss thus traced out from a recent visit, may have its limits increased by a reference to notes made in a former journey. The particulars will not be so minute, and specially the dip and inclination are wanting, as an examination of the rocks was then a secondary object, and the subject not so familiar. But they will be sufficient to establish the great extent of the gneiss formation, and I ought to add, that of the few particulars I am to mention, there can be no doubt; as I made an ample collection of specimens which I afterwards examined at my leisure, with the opportunity of consulting those who were well acquainted with the subject.

91. On the Gonass Pass, five and half miles east of the Brooang Pass, (Art. 84,) and elevated 15,516 feet above the sea, the rock is a small grained, dark coloured gneiss, with the lamina rather indistinct, and often breaking with a conchoidal fracture. The dark colour is owing to the mica, which is black. The ingredients are most intimately mixed, and scarcely to be discriminated by the unassisted eye. In the descent thence to the bed of the Buspa, (about 9,000 feet,) the rock is seldom visible, but at Singlo (9,178), and thence in the ascent to the Harung Pass (14,500), the rock is gneiss. At Mibar (9,698), the same rock prevails, and indeed as far as Pooaree on the Sutlej, between Pooaree and Poorboonnee, a crumbly white granite is met with, the type of which, as far as my memory can guide me, is to be found in other parts of these mountains, and will be described further on (Art. 264). From a recent examination between Poorboonnee and Reeba, masses or beds occur, but of limited extent, of a rock, consisting almost wholly of felspar, generally in a state of decomposition. It is probably a granite. From Reba to Rispa is again well-defined gneiss, which on the ascent above Moorung, is exchanged for clay slate. The clay slate continues by Nissung to very near Dabbling. Just above Dabbling, a mass of granite occurs, the true relation of which I cannot attempt to give at this distance of time. From Dabbling to Shipkee gneiss prevails, the laminæ and even strata frequently very much contorted, particularly at a precipice in the river bed between Doobling and Namja. Between Namja and Shipkee, it is imperfectly laminar, has a small grain, and is of a bluish grey colour. Beyond Shipkee, that is east of it, as far as it

could be judged of by contour, the mountains would appear to be clay slate.

92. To the north of Shipkee, between the Sutlej and the Speetee rivers, is gneiss, with some patches of granite, but whether veins or beds, must be left for determination on a future visit. This gneiss continues again by Nako to Shalkur, beyond which it is succeeded in the neighbourhood of Soomra and Laree by clay slate. We have thus traced gneiss very nearly to the confines of our possessions. In returning down the right bank of the river, we find it equally prevalent, the whole way from Shalkur to Woongtoo, with the following inconsiderable exceptions; limestone occurs in the bed of the Yoollung, which joins the Sutlej near Leoo, and again on the Hungrung Pass, (14,000 feet.) Whether these masses are connected, or form two distinct beds, must be left for future decision. Granite is found in the neighboured of Rarung, Meero, and Rogee: with these exceptions, and perhaps an occasional bed of mica slate and quartz rock, the whole of this line is gneiss.

93. The preceding account of the rocks of this tract, derived from recollection, agrees in the main with one published in the first volume of the Geological Transactions, new series, drawn up by Mr. Colebroke, from specimens forwarded by Captain Gerard, who also traversed that route. The chief difference is in my assignment of gneiss as the rock formation, giving to all the others, with the exception perhaps of the clay slate near Moorung, the subordinate character of beds or veins.[33] I may here add two other observations from that paper, which are not to be found in my notes, but are of importance. The dip is noticed at Pooaree as being E., and the angle of inclination 25° to 30°. The other is a notice of the rock found on the Shatool Pass, about five miles west of the Borunda Pass, and elevated 15,000 feet, which is stated to be gneiss.

94. We may now move eastward, and we shall find at the source of the Tonse (12,800 feet) gneiss again, of a dark grey colour, fine grain, and conchoidal fracture. This gneiss contains so large a proportion of

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[33] It will be readily understood, that a series of specimens collected by a person not conversant with geological enquiry, whose attention too was strongly occupied by another subject, may well fail to exhibit the relative extent of each rock; such a collection can give us no assistance in discriminating insulated beds from alternating formations, or either of these from veins.

quartz, and is so hard, as to afford sparks; at Jumnootree, also the prevailing masses are gneiss; quartz rock also occurs, but in subordinate quantity. From Jumnootree,[34] a route passes in the bed of the Bhaghecrettec at Sookee, reaching in two intances an elevation of about 15,000 feet (Bamsoora and Chaigu Pass.) The whole of this line is gneiss. From Sookee again, in the upper part of the course of the Bhageerettee, we met with scarcely any other rock; granite I have only seen in fragments. The snowy peaks at the head of this river are distinctly stratified, and have all the appearance of the neighbouring accessible gneiss. In the Jahnuvi, gneiss continues to Neeling, where it is succeeded eastward by clay slate. The valley of the Chor (thief) river, which is a feeder of the Jahnuvi, and springs from that point in which the Buspa also originates, but with an opposite course, appears to be also formed of this rock.

95. We have now reached the Kalee, (branch of the Aluknunda), and here the recent examination of this tract equally established the prevalence of gneiss, from Ookee Muth Joola (rope bridge) to Kedurnauth, the source of the river. In this gneiss the mica is often black, and the quartz glassy, and in one solitary instance if I am not mistaken, it admits of hornblende as an ingredient in addition to the other three more usual ones. The most marked varieties in structure or mineralogical aspect are the following: Near Nalaputtun, the laminæ are undulated, the quantity of felspar diminishes, and I think it passes into a micaceous schist at length by the almost total loss of this mineral; beyond Mykunda, numerous fragments occur of the glandular type before described, and which is afterwards seen in Litee, in an immense precipice forming a beautiful natural section at the foot of the descent to Jilmilputtan. Some of the nodules have even a rounded appearance, similar to that of rolled pebbles; hornblende occurs in addition to the usual ingredients in specimens obtained between Mykunda and Ukrot Kothee. This rock is also remarkable for containing a peculiar mineral, which I shall presently have occasion to describe more particularly. Near Ukrot Kothie, it has all the aspect of quartz rock, exhibiting, what may be called, a transition into that congenerous formation. It gradually loses its mica, and appears at last to be a mere mixture of quartz and felspar, the fracture conchoidal and laminar, structure very obscure. Beyond Gowree

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[34] Mr. Fraser, who traversed this route, gives the same account of the rocks, and particularly dwells on the stratified aspect of the lofty peaks.

Koond, occurs a type in which the nodules of felspar assume a lenticular shape. The ground being a dark grey, and this mineral of a snowy whiteness, makes it occasionally a very beautiful rock. Beyond Bhyro Ghate, the rock is scarcely accessible in situ, but the angular fragments, which are very numerous, are sufficiently indicative of its nature, and prove that the surrounding peaks and ridges are chiefly, if not wholly, gneiss. And the correspondence of appearance between the nearer ridges, which have evidently furnished these fragments, and the great Soommero or Kedurnauth peak attest the fact that here also, as at the head of the Ganges, this rock attains an elevation of nearly 23,000 feet.

96. The dip of this rock is more regular within this tract than in the neighbourhood of the Sutlej. In the bed of the river below Ookeernauth, near the Joola, it was observed to be from 8° to 20° N. E., while the inclination was 30°. Between Mykunda and Bhet, the dip was found to be twenty-five to forty-five N. W., and a little beyond this, due North. Beyond Mykunda again, it was observed 50° N. E. Beyond Borosa, it is also E. of N.; but the strata have a secondary set of divisions which are at right angles to the former, and consequently dip in the opposite direction. The first set have but little inclination. The latter are nearly perpendicular. This is an appearance often met with, and it is sometimes difficult to say, which are and which are not the stratiform divisions. Those have been generally adopted which correspond to the general run of the neighbouring strata. At the fine section near Jilmilputtun, the strata which are from four to ten feet in thickness, dip 10° N. E., at an inclination of 30°. After crossing the river, the dip is 30° N. E., the inclination the same.

97. The only beds observed are one of micaceous schist near Nalaputtun,—if this be not indeed a gneiss with less felspar than usual, and an instance of that oscillation which is observed between rocks so nearly allied in origin and structure as these two ? It is remarkable for containing the largest garnets (common) I have seen in these mountains. Their figure is however irregular. The specific gravity I determined to be about 3.8. This is rather higher than the determination hitherto made, but I think it must be evident to any one, who will examine the uninterrupted series of gravities between common and precious garnets, and will also consider the variations in the analysis, that the former is

merely a more or less impure specimen of the latter. The degree of impurity may be estimated from the specific gravity.

98. Between Bhet and Mykunda, also, occurs a bed of micaceous schist under much the same circumstances as at Nalaputtun, that is to say, containing felspar in small quantity; the contact with the well-defined gneiss not being visible, so as to allow it to be ascertained whether it be a bed or a mere modification of the more general rock. Beds of hornblende rock are very common, but always of limited extent; as before observed, they seldom consist of the pure mineral, almost always of a mixture of that and felspar. Occasionally this rock, by the decomposition of the hornblende and oxidation of the iron it contains, acquires a rusty colour, and an earthy composition. In this case it is soft, and partially disintegrated. And a mass of a similarly disintegrated rock, but of a yellowish grey colour, is found in its vicinity. It is probably a decomposing gneiss. A rock something similar occurs again in the ascent to Gunness Ghata from Jilmilputtun. The composition is arenaceous, consisting of quartzose particles in a white earthy basis. This is also probably a gneiss, though from the absence of every thing like the stratified structure, I am more inclined to consider it a granite. But the name is of little moment; whether gneiss or granite, it is of limited extent, and being such as I have described, is surrounded on every side by gneiss. It does not contain mica.

99. No granite veins, unless the preceding can be considered one, were any where to be observed. But fragments of great variety, size and beauty may be seen in the small valley at the head of the river near which the temple of Kedurnauth stands; all these consist in great proportion of felspar, containing very little quartz, and much less mica; some want the mica altogether, some the quartz. The felspar is always white or grey, in the former case perfectly opaque, in the latter translucent. The quartz is generally grey, the mica sometimes a deep black. Those compounds which consist of the translucent variety of felspar and black mica without any quartz, are extremely beautiful, and could this rock be obtained in any quantity, it would pay for its transport. But the small quantity in which each type occurs, is equally remarkable with the great variety of them, and their total dissimilarity to the granites found in more southern localities. They are all angular, appear to be of recent fracture, and with those

met with near Wongtoo, (Art. 87,) doubtless portions of veins, as in many the same circumstance may be observed which was observed there, the adherence of part of the containing rock to one of the sides of the vein. This is always gneiss.

100. In the bed of the Mundaknee, or Kalee as it is more usually called, below Ookeernauth, many very large rounded blocks are scattered about, of a granite very much resembling the anomalous rock at Wongtoo bridge; it contains angular nodules of a crystalline felspar imbedded in a granite paste. This felspar is here of the glassy variety, and it is the only example of the mineral I have ever found. These blocks have a smooth surface, unlike the rough and granular appearance left by the phenomenon of desquamation to which granite is subject, and to which so many granite boulders owe their origin. If these boulders have been also formed by this cause, it is equally certain that they have undergone also the attrition, which alone could have smoothed their surfaces to the degree observed.

101. The only imbedded mineral of any interest in this quarter, is one occurring in small amorphous grains. It is of a bluish grey colour, translucent, a vitreous lustre, and uneven fracture. It is very easily frangible, hardness 5.5 : 6.0. The composition is impalpable. The quantity I was able to procure was so small, that I do not lay much stress on the determination of its specific gravity which appeared to be 2.3. It is certainly not under 2.2, nor more than 2.4. Before the blowpipe it is infusible, but decrepitates. It is not affected by acids. This character does not agree with any mineral yet described, yet I should wish to obtain it in greater quantity, and subject it to a more leisurely examination before I pronounce it new, in all but geological situation and infusibility. Before the blowpipe, it comes very near the species, empyrodox quartz.*

102. Some of the fragments of gneiss found at Kedurnauth, contain kyanite in flat prisms, from half an inch to an inch in length, and about one-twentieth to one-third of an inch in breadth. Cinnamon stone in grains is also to be found in them. The granite fragments abound in schorl, under its common figure of three-sided prisms,* the lateral angles replaced, terminated by obtuse trihedral summits. The largest I observed, was about an inch in length and half an inch in diameter, but the small crystals are always best defined. Hyacinth is more rare, and the

* MSS.

crystals, which are quadrangular prisms, terminated by quadrilateral pyramids set on the angles are very small, not more than one-twentieth of an inch in their largest dimensions. Carbonate of lime, (calcareous spar,) was observed only in one specimen.

103. In tracing this formation of gneiss eastward, we find it accompany us from the bridge under Ookeernauth, by Krokee and Oosaree, in the ascent to the Toongnath Pass, (10,000 feet.) Near Krokee, it contains the bluish grey grains described, Art. 101. At Oosaree it is chloritic, the mica having given way to this mineral. The quartz is rather in greater abundance than usual, which renders it rather a hard stone, and as the laminæ are very much undulated in the south wall, and the rock splits readily into masses of the required thickness, it is found valuable as a mill-stone, and is much sought after on the Pass. Well-characterised gneiss, of a small grain, and marked schistose structure, occurs. The dip was observed to be N. 20° E. It was particularly obvious in the arrangement of the mountain slopes and precipices. Fig.* will give some idea of this appearance.

104. Beds of hornblende schist, as usual, are met with, sometimes in a state of decomposition, (between Krokee and Oosaree), sometimes persistent (on the Pass), but in a very small quantity. It is here succeeded laterally by clorite schist, which also occupies a very small space, some very large masses of quartz rock are observed, which have evidently been derived from the lofty crest that crowns this Pass to the north. A small strip of granite of a middling grain and ordinary aspect, occupies the eastern edge of the Pass, and is I think, part of a vein. In the descent in the Pass no rock is seen in situ, but the fragments are all gneiss, and one type in particular is singularly beautiful, having thin prisms of kyanite dispersed through it in great abundance, thus giving it something of a porphyritic aspect.

105. The next locality within the elevated zone where gneiss has been traced, is at Dampa on the Gooree river. It was there observed under two types, interstratified with one another. The one a light grey, having much the appearance of quartz rock, the other darker coloured and larger grained, resembling the rock near Zanee on the Sutlej and

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* The figures referred to here and other parts of this report are wanting, for the same reason that has interfered with the preparation of the sections. They will be forwarded hereafter.—MSS.

Jilmilputtun on the Mundaknee. The two types are interstratified. The dip is very regularly N., a little E., and the strata are occasionally curved amongst the fragments, besides gneiss which constitutes the major part. Quartz rock was observed, and a few spots of hornblende rock, but none of granite.

106. From this point in the ascent to the village of Sacen, gneiss is the only rock observable. Thence descending to the Nullah, and ascending to the Pass called Chabinna-ka-Doora, elevated 9,000 feet, the same rock continues, and in the whole line of so ordinary a type, and presenting so little new or anomalous, as to afford no room for description or remark. It yet accompanies us onward round the head of the Soorung glen to the Pass of Rooroo Dhooroo, elevated 10,000 feet; the line of route then descends to a Nullah, (elevation 6,000 feet). Gneiss the whole way. It ascends and descends, passing round the head of a valley, and finally crossing Sere Soongur Khan, a Pass elevated 10,000 feet, descends by Naneik into the bed of the Ramgunga, having yielded no rock but gneiss in all that line, not even a solitary bed. I ought however to notice that in a very great proportion of this distance the coat of debris is of an enormous thickness, and covered by a most luxuriant vegetation. In the bed of the Ramgunga, the dip was observed N. 5° W., the inclination being 15°. There were however two other sets of divisions, but not equally strongly marked.

107. The preceding comprehend the most northern observations of the extent of this rock. I shall now follow out its southern boundary, which as it presents some anomalies and irregularities, I have chosen to separate from the previous detail in order to avoid confusion, and to present in a clearer light the fact of the great lateral extent of this formation. I have not the least doubt, that a greater field of observation will establish the general prevalence of gneiss over the whole of what I have called the zone of the Himmalaya. It is true that this is mere opinion, but it is the opinion of one who has considered the outlines of the mountains with reference to their geological structure, and who may be said to have viewed the whole of it at greater or less distances.

108. I shall, as before, begin with the western parts, taking up my account at Deas on the Sutlej where, as I mentioned, gneiss occurs of a well characterised type. In the bed of the Nullah, between Deaoo and

Muzzooleea, may be seen a bed of chloritic schist. Dipping conformably with the gneiss it oscillates on one side towards talcose schist, on the other towards chloritic gneiss. The latter change is seen where it comes into contrast with the gneiss. This intermediate rock, as it may be called, is much intersected by veins of scaly chlorite in which quartz is also interspersed. The veins are very tortuous, and the quartz always follows the course of the chlorite. In the ascent to the Kutedorna Pass, just below the village of Darna, gneiss was observed, but of limited extent, and no other rock was visible.

109. Between this Pass and Putenoo I find no notice of the rock, owing I suppose to thick debris below Putenoo. In the route leading down that glen, one of the feeders of the Nowgree (to Roon on the latter river) chloritic and talcose schists are the only rocks observed, these rocks frequently contain quartz. The dip is generally north. The contact of the gneiss with the new rocks could not be discovered. In the bed of the Nowgree occurs an anomalous variety of talcose schist, or perhaps rather quartz rock. It is a mixture of silvery talc and quartz, but is not schistose, having more the amorphous aspect of granite. It contains, disseminated in grains, a mineral with the lustre of quartz, semi-transparent, varying in colour from a bluish white to an indigo blue. It does not appear to have any cleavage. The quantity was too small to determine the specific gravity. It is infusible *per se*. With soda it forms a clear glass. This rock has been meet within very distant localities, and will be often referred to. At this place it is intersected by patches or veins of chlorite.

110. In the ascent from the Nowgree, fragments of a subschistose rock, of a greenish colour, may be seen, containing probably hornblende, besides chlorite; still higher on the pass above Birsoot, straight laminar chlorite schist prevails. In descending to the stream below Ketoo, the same rock continues, but having a fibrous structure; it contains nodules of quartz, and the chlorite is always observed to be bent round them. The dip was found here to be S. E. In the bed of the stream blocks of gneiss are seen, but no occurrence of it in situ. Chlorite schist continues to the foot of the ascent leading to the village of Koolior, when it is exchanged for a grey fibrous argillaceous schist, irregularly cleavable with a scaly granular fracture. The dip here was also found to be S. E. Probably this latter is in reality but a variety of chloritic schist. As long how-

ever as the green colour is made the discriminative character of chlorite, descriptive geology must notice it as a change.

111. This latter rock continues in the ascent beyond Teda, assuming latterly a magnesian character, and containing veins of quartz. The transition between magnesian clay slate, and talc slate with which chlorite slate is associated, is so common, as to render the above conjecture probable; masses of a rock which might be called quartz rock are then met with. It is of a fine granular composition and slaty structure; a little higher an enormous precipice occurs formed of the projecting ends of the strata, and facing the north. This rock is a gneiss of a grey colour, fine granular composition, and perfect schistose structure, and the dip, it would appear from the above, must be South on the Sulan Pass; again the rock is gneiss, but no observation of the dip could be made.

112. In the descent from this Pass to the village of Koornoo, so thick is the coat of debris, that not a single example of the rock is to be detected excepting fragments. These are gneiss; but from Koornoo the rock is finely exposed, particularly in the bed of the stream which leads from the bridge below Koornoo to the foot of the Pass above Surmal, and which here separates the Sutlej basin from that of the Jumna. This stream runs in a narrow gorge with high perpendicular walls on each side, formed of the projecting ends of the strata. These are observed on each side to correspond perfectly, not only as to the seams and directions of the strata, but also in the mineralogical character of the rock. This rock is an ordinary gneiss of a grey colour, and marked schistose character, the strata are sometimes five feet thick, and between them is a distinct separation or fissure; sometimes they are not more than six inches thick, and these changes occur within a very short distance, the dip is regularly S. 40° to 50° E. The inclination 15° to 25°.

113. In the neighbourhood of the Surmal village, gneiss is still found, occasionally, however, almost losing its felspar and consequently oscillating towards micaceous schist or quartz rock. The route from this village to Kuatar, at the head of the Nocor glen, leads along the high ridge which separates the basins of the Sutlej and of the Jumna. This ridge has an elevation in this quarter of from 7000 to 11,000 feet; some parts are above the limit of forest. It rises rapidly as it continues upwards, and is seen to be crowned with snow-bearing peaks at but a

short distance from the Pass above Surmal. It is generally covered with an enormous coat of debris and of peat, but the rock is visible in more than one place. It is gneiss, occasionally small granular, occasionally with bent laminæ, and resembling the passage into micaceous schist. The dip is as often S. E. as N. E., nor did there appear to me any clue by which I could trace the connection of their opposite dips, which are many times repeated even in a very short distance. Beds of hornblende rock are frequent; this rock is very often quite amorphous, and has but little of any appearance of a schistose structure. It occasionally contains mica and even quartz, as well as felspar, and may thus be said to be identical in composition with the syenites, but it never loses the characteristic appearance of hornblende rock, and the above minerals are always in small quantity.

114. In the descent from the Kedrolo Pass to Kutar, the gneiss is latterly found to lose its felspar, and in the neighbourhood of that village it is an ordinary well-defined micaceous schist. From hence this latter rock continues in the bed of the Nocor river, lying at so low an angle that it is difficult to observe the dip or direction. I should have observed that the outline of the great ridge and its ramifying branches, from which the Kedrola Pass forms the descent, is peculiar. It is sharp and serrated, while that of the mountains east of Kutar, and even the branches of the former, as they fall in the scale of elevation, are observed to assume smooth rounded outlines, with scarcely any sharp peaks or breaches. But if the smooth ridge is seen to rise to any thing like the elevation of the serrated ridges, it also becomes serrated like them, while again on sinking, it takes the rounded form. This fact, combined with the low degree of inclination which the strata bear, would seem to justify in inferring the superposition of gneiss on micaceous schist, nor is there any thing so unusual in the fact, however contrary to a once generally received system, to occasion any hesitation in admitting the truth of it.

115. In the bed of the Nowr river, besides fragments of the mica slate, the rock in situ many large blocks are seen of gneiss of a type which I did not observe any where in this quarter in situ. Judging however from the connections of this rock in other places, I would infer that it must also be in abundance here, forming most probably those serrated crests which crown the mica slate ridges. This rock may be called a porphyritic gneiss. It is composed of rather a middling grained

paste, in which I believe the three ingredients are found, and in this paste are included angular nodules of crystalline felspar; this arrangement gives a very beautiful appearance to the rock when polished. It is the same rock which has been noticed in the river Kalee below Ookeemuth, and also at Wangtoo bridge. It appears very often to form the transition between granite and gneiss.

116. The micaceous schist continues to the village of Kohaen, situated below the foot of the Tekkar, but every where covered by a thick coat of debris. In the nullah the tendency of the dip was, if any thing, East; but here it was observed to be South-west. Below the village, a small stream joins the Nowr river. In the bed of this river, micaceous schist is still observable, but on crossing the river on the ascent to the village of Surmal, gneiss is seen resting on it. The dip of both rocks North-east, and the inclination very little. The mica slate has here a greenish colour, but it is not chloritic. The relations between micaceous and chloritic schist do not warrant, I think, our extending the latter title to those rocks of the former class, which have merely a greenish tinge. The lines of chloritic schists are rather connected with the talcose schists, a connection perfectly agreeable to our views of system, since it has been well established that the two minerals, talc and chlorite, are but varieties of the same species, (the prismatic talc mica of Professor Mohs.)

117. From Saraut to Seel, the route passes along the eastern declivity of the ridge which separates the Nowr glen from the valley of the Girree and its feeders. This ridge is every where of the rounded and swelling form which was mentioned as indicating micaceous schist, accordingly it is the only rock observed. It is frequently of an arenaceous composition, and strongly resembling some varieties of micaceous sandstone. This type occurs near the village of Kulgaon, occasionally it is of an earthy aspect, loses its schistose structure, and becomes fissured in every direction. This type projects through the surface in amorphous masses; it very probably contains felspar, though the grain is too small to detect it by any occular examination. I incline to consider it as in reality a small grained decomposing granite, but further examination of its relations to the surrounding rocks are necessary to enable me to pronounce decisively.

118. From Seel to Deolara, the residence of the Ranee of Torbut, the route turns up the valley watered by the stream which joins the Pubbar

river, opposite to Raeengurh. In all this line, mica slate is the only rock occurring in situ. The dip was observed to be N. W., inclination 15°. Several very large fragments of gneiss may be seen near the village of Torbut; one which I noted, had the dimensions of 50 feet by 20 by 10. Whence these have come is not so obvious, for the crests of the range do not bear the serrated outline which is here discriminative of gneiss. Near the Deolora, the type consists almost wholly of mica, very tender, and of a yellowish brown colour. It contains numerous veins of quartz, as this type always does. The new road which has been cut by order of Major Kennedy passes through it, and is covered deep by the highly comminuted debris of this rock, the lightest and most transportable sand that is formed. The annoyance to the traveller's eyes in a light breeze is not to be described, while the sun strongly reflected from the lamina of the rock, occasions a glare which is almost as irritating to the eyes, as the subtile powder which is every instant blown into them.

119. At Seel, the rock is of the arenaceous type, and it contains, disseminated in great abundance, octahedral iron ore in small grains and imperfectly formed crystals. This mineral has a specific gravity of 4.81; but as there are some impurities in the specimen I tried, it is probable this determination is too low. The limits of octahedral iron ore are 4.8, 5.2, while those of axotomous iron ore, which it in some respects resembles, are 4.4, 4.8. But it is very probable that the true limits of the octahedral species, (magnetic iron ore,) do not descend below 5.0, for all the massive or larger crystallised specimens exceed this determination, and that the magnetic iron sand will form a distinct species between the axotomous, (titanic iron,) and the octahedral.

120. The abundance in which these grains are found, may be judged of by the specific gravity of some of the specimens of the micaceous schist in which they are disseminated. This was found to be 3.45. Taking 2.76 as the specific gravity of pure micaceous schist, and 4.8 that of the iron, it may be easily demonstrated that the latter constituted by bulk one-third of the rock, or by weight very nearly one-half.

121. In ascending from Deohea to the Pass of Chount Kagulla, leading into Poondur, micaceous schist alone is observable, but in general in the coating of debris thick fragments of gneiss occur, and it is probable

that the summits of this range are composed of this rock. On the Pass, micaceous schist is the rock; but it approaches in character to gneiss, containing I think felspar, though in small quantity. On the other side of the Pass, however, just at the edge of the steep descent, gneiss occurs in strata very nearly horizontal, the dip being if any thing North-west. This place, which is at the head of the glen in which is situated the village of Meemooa, presents some very romantic scenery. Immense precipices are formed of the columnar masses of gneiss, which here and there stand out from the general rock, and raise their gigantic heights far above the green knolls and patches of debris, enamelled with a thousand flowers that fill up the bottom of the glen. The crests of the surrounding ridges in which the gneiss is gradually lost being concealed by the luxuriant vegetation, are again crowned with noble forests, in which the yew, the horse chesnut, the oak, pine, and sycamore are all conspicuous. At every step the traveller disturbs the Moonal, (Phasianus Impeejanus,) which with its shrill disagreeable cry forms the only interruption to the silence and solitude of the scene. It was a beautiful morning in May when I ascended it. The thermometer was only 50°, while in many of the secluded nooks, the springs were frozen. It is in scenes like these, and in such temperatures, that the explorer finds some recompense for the heat, and toil, and dust of less favored situations.

122. Descending into this glen, the gneiss is perceived to have considerable extent, and the valley for a still further distance, is strewed with huge blocks of this rock. At the precipices above described, a brownish tender micaceous schist may be seen resting on it; lower down in the bed of the nullah below the village of Mummora, the gneiss is finally exchanged for that rock, which here again appears to underlie it. It may be seen to form by the broken ends of the strata, corresponding layers on each side of the narrow water-course which it bounds, the two sides agreeing in mineralogical character, in inclination and thickness of strata so closely, that it scarcely requires an effort of imagination to fill up the very narrow chasms, or to join those masses which have evidently been once continuous. The micaceous schist continues in the high ridge on which the village of Pooree is situated, and for a few miles beyond it, when it is finally lost through the junction of the new rock, or is concealed by debris.

123. I have now traced the gneiss to its southern boundary in this direction, and have, in order at once to notice all the different patches of it that occur, encroached on the limits of the micaceous schist, the next rock in the order of description. But no arrangement of these observations can be entirely regular while nature herself so often presents us with irregularities, or at least what appear such in our imperfect systems. In fact the inconvenience is more imaginary than real, for in following out the extent of the next rock, the preceding details will be referred to as filling up part of the outline. No gneiss is found south of the point where the preceding description terminates.

124. It is necessary now to return to the route by the Borund Pass, in which gneiss was traced as far as the place of encampment in the Pubbur valley, about 10 miles above Janglag. The upper part of this valley, I should notice, is of great width, the left bank is steep and precipitous, consisting chiefly of bare rock, the river flowing at its foot. The right bank is an easy slope covered with a thick coat of peat, in which spring up at this season various European flowers, such as ranunculus, anemone, potentilla, iris, with many others that appeared new to me. Tracts of this nature afford the very finest pasturage during four or five months of the year. Very little rock is visible, only occasionally in the lateral glens, where the torrents from the snow have gradually made their way through this enormous mass of vegetable debris, and thus exposed it to view, or where a peak split by the expansive powers of the frost tumbles from its lofty base into the valley beneath, and scatters wide its fragments of every size. One such slip of very great extent may be seen on the road to Junglag, and of this all the fragments are gneiss; some pieces would afford hand specimens that might pass for granite, but viewing it in the large and almost innumerable blocks that lie here, the rock is readily pronounced a gneiss.

125. Descending from Junglag to the confluence of the two principal branches of the Pubbur, we find only gneiss. A fine section is exposed on the left bank of the eastern branch. It lies in distinct and well marked strata, from 5 to 8 feet thick, dipping to the S. E. The route continues along to the right bank of the united stream now swelled to a river, 40 feet wide and 5 feet deep. The coating of debris is of great thickness, but another section of the strata may be seen in

the bed of a small nullah that falls in from the west. The rock is gneiss, the inclination is small, and the dip obscure.

126. Hence, ascending and passing by the villages Dewtee and Sustwar, gneiss is still found projecting in many large masses; the mountain side being more steep, and consequently having less debris lying on it, no good observation of the dip was obtainable. Gneiss still continues up the lateral glen in which Kutsar is situated, and thence descending to Tikkaree near the latter place, fragments were observed of a dark blue colour and small grain, and in the eagerness to change the sameness of constantly recurring gneiss for some novelty, were supposed at first to be so, but the first stroke of the hammer corrected the mistake, and shewed it to be gneiss; a little unlike, however, the ordinary types of that rock. In the bed of the Kutsar glen, blocks of the porphyritic gneiss before described were observed, some of which had all the characters of a gneiss.

127. From Tikkaree to Senowlee, a distance of nearly 16 miles, the route is in the bed of the river, and in all this line there is but one instance of the rock in situ being exposed. It is a fine grained grey gneiss. In the bed of the river, fragments of all sizes are seen, but they consist almost exclusively of gneiss and quartz rock, some few of hornblende rock, and a very few of granite. The river bed is often wide, and in these cases is accompanied by a bank or flat of some extent, consisting of rounded stones. This bank is often 30 feet high, not less than half a mile in length, and 200 yards perhaps in width. These level spots are all cultivated, and it would appear, that they are particularly fitted to the culture of the poppy, which is carried on in this valley and its ramifications with great success.

128. This was the first instance of these beds observed in descending from the source of the river. Near Massoolea, where there is much level ground, occurs an immense accumulation; a lateral torrent which cuts through it to join the Pubbur, shews at once its enormous thickness and its composition; stones of every size, from 2 feet diameter to the smallest pebbles, all perfectly rounded, imbedded in gravel and sand; most of them are quartz rock, perhaps two-thirds of the whole, the other third consists of gneiss and hornblende rock, with a few of granite. These beds are so far different from the open level spots found in the upper part of the river vallies, in as much as their surface

is perfectly flat, while that of the others is rather undulating and irregular. The latter too are composed almost wholly of angular local debris, covered with a thick deposit of peat, while these, as already described, consist entirely of rounded fragments which project often at the surface.

129. From Sinowlee the road ascends one of the ramifications of the Chag Sheel ridge. At the commencement of the ascent, micaceous schist is found of a dark blue colour, and splitting into very thin straight laminæ. It is much stained with oxyde of iron. Gneiss succeeds to this rock, but in small quantity, and is again exchanged for a micaceous schist, with something of a talcose aspect, and of a lead blue color. This rock continues assuming more of the talcose character, and it is I think certainly a mixture of prismatic and rhombohedral talc mica with quartz. The laminæ become undulated, and it abounds in garnets. A vein is observed parallel to the layers, the centre of which was either granular quartz or a mixture of quartz and felspar, the sides were marked by prisms of hornblende thickly and confusedly disseminated. Many veins of glassy quartz, both white and yellow, were observed, but so fragile that no good specimen could be detached.

130. The rock continues to the village of Chupar, containing frequently veins, if they be so called, of gneiss. The veins never ramify, and they are always parallel to the laminæ of the containing rock; below Chupar gneiss is again found in mass, and beyond it again talco-micaceous schist, enclosing a vein similar to that described Art. 129, consisting of granular quartz or a mixture of quartz and felspar, with crystals of hornblende disseminated. This vein has a porphyritic structure, is a most singular rock, and affords by the definite nature of its character, a clue to the connections of widely distant masses. It will be seen hereafter of what common occurrence it is within this tract, and yet it is a rock I have never seen except in these mountains. The dip is pretty uniformly in this neighbourhood, N. or E. of N. wherever it appears uncomformable, it is but for a short distance.

131. Beyond the talco-micaceous schist, one with straight laminæ, containing garnets and oxydulous iron is met with. In descending from Bulor into a lateral glen, the glandular type of gneiss before noticed as occurring below Broang (Art. 80), and at other places, is met with, and in the bed of the stream is seen a talco-micaceous rock with

undulated laminæ. This rock is singularly hollowed out, whether by the action of the weather or by the dropping out of the loose materials of veins, that may once have traversed it, it is difficult to say, perhaps the former opinion is the more probable one; and yet as these hollows traverse the laminæ of the rock, it is not easy to understand why they should be subject to decomposition so partially.

132. From Murdal the rocks appear to be of an anomalous character. In proceeding along the declivity of the range which here forms the left bank of the Pabur river, there is an oscillation between gneiss and micaceous schist, the rocks occasionally assuming the type of the former, occasionally of the latter rock. The gneiss appears sometimes to contain clay slate as an ingredient, and in one spot of limited extent, is carburetted in a high degree, this modification was noticed, also as occurring above Gowree Koond, in the valley of the Kalee, (Art. 95.) In the bed of the stream below the village of Twalta, gneiss is found of a legitimate type, dipping to N. E. and having an angle of inclination of from 30 to 40°. This rock continues the whole way to the village of Dorchan, where may be seen some types of a granitic character, but viewed in all their relations, little hesitation is felt to class them as gneiss in general, this character only applies to small portions of the rock, and even there may be seen in the same continuous stratum to pass into the most ordinary gneiss, and often in a distance of a few feet. The laminæ of this rock are much undulated, and owing to the arrangement of the materials, it presents a striped appearance, the stripes following a waving outline. In some specimens, I observed the spangled mica at right angles to the laminæ, an arrangement that might too hastily be considered characteristic of granite, were it not borne in mind first, that they preserve their parallelism in layers, which the mica in granite never does; and secondly, that it is an appearance not uncommon in micaceous schist, as I shall hereafter have occasion to shew, contrary to the opinion of one of our first geologists.

133. In the descent to the Kotee gneiss accompanies us nearly the whole way dipping to the north or a little west of it, the inclination being but little. It is however seen to include a bed of magnesian clay slate, the approach to which is indicated by laminæ of that rock being contained in the gneiss. Adjoining the bed of clay slate, is one of quartz rock. The actual junction of these rocks is concealed by

debris. The change however takes place in the direction of the strata, and does not occupy 400 yards in lateral extent. The gneiss which succeeds the quartz rock continues as far as Gokul, a village in the same glen. In the ascent thence to the pass above Seras, the rock in situ is not observable; for a considerable distance fragments of hornblende schist are found, but not numerous; after crossing the stream a new rock is met with, which occupies some extent. It is a white rock of a saccharoidal aspect, occasionally so frangible as to crumble under the pressure of the finger, yet at the same time it has many and distinct changes, but nothing like a schistose structure. It is most probably a bed in the gneiss. It is composed evidently of talc and quartz or felspar, or both; some parts of it have so completely lost the mutual coherence of the particles, as to form apparently a bed of white clay; no doubt this would prove an useful ingredient in any attempt to manufacture a superior pottery.

134. On the summit of the Pass is to be seen a gneiss of an earthy character, and containing not only clay slate, as an ingredient, but carbonate of lime. Below the Pass occur fragments of chloritic schist, in such abundance as to justify the suspicion that there are extensive beds of it in the neighbourhood near; the village, a compound rock of an argillaceous character containing superadded carbonate of lime, imbedded pieces of quartz of a lenticular shape, and perhaps felspar; most probably the transition of the earthy gneiss above to an argillaceous schist; another specimen is a well defined clay slate with veins of carbonate of lime, chloritic schist of a dull green colour, and subgranular composition, united to the imperfect schistose structure, also occurs, after which quartz rock in all its types occupies the road in the descent to the Tonse River, and for some miles in its bed, proceeding upwards: when I say in all its types, I mean rather of colour than any thing else, for excepting in this particular there is no rock which possesses such uniformity of character, at least in this tract. It is sometimes bluish grey from clay slate, sometimes greenish grey from chlorite. Occasionally it is talcose, occasionally micaceous; the dip is pretty uniformly from N. to N. E. and the inclination from 25° to 30°; a very remarkable instance of the disruption of the strata occurs in the descent, something like that noticed Art. 94. The interval is also occupied by a stream, but of very disproportional dimensions. It is about

four feet wide and six to twelve inches deep, (15th of June after many days heavy rain,) the breadth of the opening from precipice to precipice is 200 feet, and the perpendicular depth about 100. The dip and mineralogical character correspond on each side, so as to leave no doubt that they were once continuous. The rock, as quartz rock almost always is, is one of great tenacity and hardness, and it seems very difficult to assign any adequate cause for the removal of so large a mass. There does not appear any dislocation or disturbance of the strata, nor any trace by which it can be judged, that the mass removed could have been the materials of a vein of less persistent character; many other instances of this kind will be noticed as I proceed in my description.

135. The Tonse is here crossed by a Sanga which measures 101 feet in the clear. The velocity in the middle of the surface was 12 to 13 feet per second, and the depth from 5 to 7 feet. These data give the discharge about 2000 feet per second. In the Doon before joining the Jumna it was determined to be nearly 3000 feet. In its immediate bed are found very large rounded blocks or boulders some even 3 feet in diameter. As in the bed of the Pabbur River, so here also they consist of gneiss, quartz rock, and hornblende rock. At the confluence of the small stream in the bed of which lies the road from Seras, there occurs a very extensive piece of flat ground, but whether it be composed of the boulders, and loose gravel noticed in the bed of the Pabbur is doubtful. Small deposits were however observed in the immediate bed of the river, having a thickness of 5 feet. The open and flat spots are very numerous in this part of the river's course, but of what materials they consist is rendered uncertain by the covering of vegetation, which clothes their slopes even to the water's edge.

136. From the bed of the Tonse the route proceeds up a lateral glen called Gurogar, from the village of that name, a very picturesque valley having considerable width, and much level ground in many different points of its course. The sides are sloping and covered with forest, which with the luxuriance of the vegetation spread over the floor of it effectually conceals the rock; in one quarter numerous fragments of quartz rock may be seen something of the character of the rock noticed in Art 129, as found on the ascent to Bouchakadhar. It contains talc, and is frequently very tender almost friable. They are scattered over a smooth grassy knoll, nor is it immediately obvious

whence they come. The mountains on this side have flat declivities, without any rock visible, and are covered with fine forests; on the opposite side, it is true they are precipitous, and appear to consist of this very rock, but as the river forms a deep chasm between, and not a very narrow one, it is not immediately understood how they should have fallen on this side: perhaps they had occupied their present place before this chasm was formed.

137. The valley widens considerably at its upper extremity, but constantly presents the easy grassy declivities, or patches of forest, which so entirely cut off all access to the rock. The ascent is easy to the Dharma pass, which separates this valley from that of the Koomoolda, commonly known as the Ramasera, (note, Sera is always applied to those vallies where rice may be cultivated.) The latter is a valley of some note, and is thought by the mountaineers, of these otherwise, rugged districts to be a smaller kind of *des*,* but their praises and description of it are greatly exaggerated; there are several vallies in Kumaon and to the westward of greater extent. Its extreme width cannot be taken I think at more than a mile, and the length of the wide part, — miles; towards its mouth it narrows considerably, and the Koomoolda, the stream which waters it, finally joins the Jumna by cutting its way through a narrow ridge which lies transversely to the valley, and which has all the appearance of having once formed a barrier to its waters.

138. On the Pass were found fragments of quartz rock occasionally containing talc, and of chloritic schist. The latter rock with bent laminæ and oscillating towards talcose schist, was found in situ half way down the Pass. In the valley again gneiss once more makes its appearance in very thin laminæ, and dipping to north. This gneiss is very probably connected with the mass which rises up into the lofty peak Kedar Kanta, in the sides of which both the Gurogar, and Rama vallies have their origin; on crossing the valley quartz rock and chloritic schist are the only rocks to be observed, and of these even very little, owing to the arrangement of the surface and the deep deposits, either of debris or peat, which every where conceal the rock. One very large mass was observed consisting half of quartz rock, half of chloritic approaching to talcose schist, there was nothing like transition observable between the two substances, the line

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* The term applied by the mountaineers to the plain.

of junction being strongly marked; the quartz rock was perfectly amorphous, not a trace of schistose structure was to be observed, the laminæ of the schist were considerably bent or undulated, it contained fragments of the quartz rock, some of which were coloured green, some retained their white colour; no fragments of the schist however could be detected in the quartz rock; this mass which appeared detached was surrounded by several smaller blocks, some of which were found to be quartz rock, some chloritic schist.

139. The route passes round the head of a second valley, which falls into that of the Kumoulada, and crossing the lateral separating ridge descends into the valley of the Bunal, another glen containing a good deal of level ground, though not equal to Ramasera or the Gurogar glen. In the descent above the village of Kande, gneiss was once more found, but down the valley, the mountains, at least their summits, appeared to consist of limestone; this gneiss was talcose, approaching to earthy, and it is again found below this village in the neighbourhood of limestone beds, and containing a bluish semi-transparent mineral in grains similar to that described (Art. 126.) Here the gneiss formation is finally taken leave of, being succeeded by talco-argillaceous schist.

140. We must now proceed to the valley of the Kalee, and trace the southern boundary there also. The former account stopped at Ookemuth on the Kalee. In a glen a mile south of it, is seen a schist full of those flat veins or circular masses of quartz which are so common in micaceous and argillaceous schist; this rock dips 45° NE., and has an inclination of about 30° to 40°. Between the villages Jukh and Oakee again, gneiss is met with; below in the bed of the river is a mass of calcareous tufa with vegetable impressions. It is of a light buff yellow colour, is rather porous with a semi-crystalline grain. It is a very pure carbonate of lime, and affords an excellent cement by burning, which was used for the stone temples erected one at Kedarnath, at the foot of the great Soomeeroo Peak,* the other at Ookee Muth where the Raool, or chief priest, resides.

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* This temple is situated at the source of the Mundaknee, a branch of the Dhaolee, in one of those expanded vallies described in Art. 95. The elevation of the place is — and it is unnecessary to say that during many months it is deep in snow, and consequently not habitable. There is even no village within 15 miles of the place; it it rather larger than the generality of these structures, and is handsomely built of hewn stone.

141. Chloritic schist is seen again at Kandara in the Greenduala glen, which furnishes a middling sized stream to the Kalee; beyond the chloritic schist-gneiss is again found near the village of Baroo, Amorphous patches of earthy granite may be observed, so soft and crumbling as to yield easily to the spade. On the summit of the Pass a talco-chloritic schist obtains, and continues to the mines at Pokree, fragments, however, of hornblende schist being scattered about in some numbers; beyond this point no gneiss was observed in proceeding south; we may therefore return to Mumdal below the Toaugnath Pass, where the account of this formation left off. (Art. 103.)

142. This village is situated in the high bed of the Dulalee river, which has its rise in the schist of the Toongnath mountains, and joins the Dhoalee just below Gopisur. The route leads down the glen to turn into the valley of the Dhoalee; very little rock in situ was observed; indeed only one patch, which was of too little extent to say precisely whether it was granite or gneiss, the toughness being such as to set at defiance the hammer, and consequently prevent its effecting a fracture of the rock, so as to judge of its mineralogical composition. It was a roundish amorphous mass with a few irregular seams projecting but little above the surrounding surface, and thus, from its want of sharp corners, increasing the difficulty, occasioned by its toughness, of detaching a specimen. Fragments of hornblende rock, of quartz rock, and of gneiss, are abundantly scattered over all this tract. One block, probably part of a vein, was observed, consisting almost entirely of that variety of hornblende called actynolite; part of the containing rock still adhered, being a fine granular mixture of felspar, quartz, and mica, the first ingredient in greatest quantity. The actynolite has rather a confused structure; apparently large concretions formed of radiating bundles of prisms. The specimens obtained were not remarkable for beauty.

143. A more remarkable phenomenon was the occurrence of a huge mass, composed apparently of very similar ingredients to the secondary sandstones. It was a solitary rock which stood in the bed of the Dulolee, the top being covered with grass and shrubs; strictly it might be called a conglomerate, containing many large boulders or rounded stones. The base was rather fine grained, consisting almost entirely of quartz sand, and apparently held together by the slightest

coherence. The friability and want of consistence of the substance, prevented the retention of any specimens, as they fell to pieces immediately on being detached, though the rock itself, of considerable size, seemed persistent. I am inclined to think it was merely part of a diluvial deposit and not a legitimate sandstone, no specimen of which I have ever observed in such a locality. In reality though the sandstones are often friable, and have little coherence, yet I have never seen any which exactly resembled this rock.

144. At Sikol, in the bed of the Dhaolee, I found large masses of quartz rock stratified, probably with great regularity, but the fissures of the strata so intermixed with cross cleavages, that it was difficult to separate them, and say which really was the plane of the strata. The colour of this rock was greenish, it is also seen near Masooa, rather a large village near the rope bridge by which the Dhaolee is here crossed. The dip was N. E., inclination about 60° to 70°; close by the bridge it appears to pass into micaceous schist. Further on in the valley of the Mundaknee, it appears to pass into chloritic schist.

145. I must not leave the Dhaolee, however, without saying some thing of those great accumulations of boulder stones, the very sight of which strikes the traveller with astonishment, and forces him to admit the action of some great rush of waters. These diluvian beds are here seen on a scale, which sets at nought any theory that should derive its agent from the body of water at present occupying that channel. These deposits seem always to be found in those parts of the river's course where the valley widens considerably, at least it has been so in all the instances I have yet had to notice. In the immediate bed of the river, the fragments consist of two kinds, the one perfectly rounded, the other subangular. The rounded fragments consist of gneiss, granite and hornblende rock, the other of quartz rock and mica slate, the two latter being the rocks in situ in the immediate neighbourhood of the rounded fragments; these are of all sizes from boulders of four feet in diameter to the small grains of sand. That the river in its greatest floods, and in some particular parts of its course possesses the power of moving these stones, is certain, from the deep hollow noises heard every now and then. That it can do little more than merely move them is equally certain, from the fact of these boulders always occupying the wide parts of the valley. There are tracts here of a mile in length, and

probably 300 feet wide, (the depth is not known), consisting of these huge stones, great part of them now far above the reach of the highest floods. It is not to be understood, if they had been moved by causes still in operation, why none of them should have travelled a little farther.

146. Ascending to Sooralee from the bed of the Mundaknee, chloritic schist is found established, extending for some miles beyond the village to the foot of the Okrooaree Pass, which separates the Purgunnahs of Budhan and Dussolee. It is as usual much intermixed with quartz rock; some specimens of a straight laminar structure have an emerald green colour, and an almost metallic brilliancy. This is a beautiful rock. On the descent from the Pass gneiss is found of a small grain, a very compact rock. The dip is N. 80° E. the angle of elevation 60°, hence passing by the village of Koon to Choptah, quartz rock and chloritic schist prevail irregularly mixed. The dip generally N. E., the inclination 25°. At Chobtah, they are exchanged for an earthy micaceous schist, which however must be of very limited extent.

147. Below this village, on the road to Jak, the rock is of a less definite structure, being an irregular mixture of dolomite and talc; sometimes the grains are small and the mixture intimate, sometimes they are larger, and the aggregation of a granitic character, *i. e.* each mineral perfectly distinct, though mutually impressing each other. These distinct concretions become so large, that each mineral may be found forming the substance of distinct blocks. This type of rock occupies but a small space, being found only on the right bank of the glen below Chobtah; on ascending the other side, fragments of a granitic rock are met with, but of peculiar mineral character. The ingredients appear to be a dark bluish grey felspar, quartz and talc, the grain is small, the rock exceedingly tough and hard, with an amorphous structure, although some specimens shewed something like a transition into the schistose. This rock was not seen in situ, only in fragments, and has near been observed in any other locality. It is a very beautiful rock, and would be extremely ornamental if cut and polished.

148. Near Jak, beds of hornblende schist occur, apparently graduating into quartz rock; on the quartz rock, which contains felspar, rests a bed of chloritic schist of scaly composition and unctuous feel. These two rocks are perfectly distinct, and the line of separation strongly drawn. The dip is N. 60. E. and the inclination 40. Below them in

the descent to the Pindar much quartz rock occurs, dipping always N. E., but having frequently a second set of cleavage planes equally distinctly marked. The only method of recognising them is the greater or less permanence, the false stratification if it may be so called, often vanishing within short distances. At the foot of a precipice formed by a beautiful natural section of a quartz rock containing felspar/ is a patch of grey rock, amorphous, without any trace of schistose structure, and projecting in large round masses, very similar to those which granite is seen to affect. It is probably a mixture of hornblende and felspar. A whitish rock of a small grain, and similarly amorphous, is seen in contact sending veins through it, and reminding one strongly of the description given of granite veins. This white rock is similar in mineralogical character to the stratified rock above noticed, consisting of a mixture of quartz and felspar. The fragments in the bed of the stream are chiefly gneiss and hornblende rock; they are frequently increased by calcareous spar.

149. On descending into the valley of the Pindar a greenish grey schist is met with at the rope bridge. Character intermediate between hornblende and chloritic schist. It probably belongs to the former title, though the fragments and other indications beyond this place point to a formation of talcose schist. Fragments are also met with of gneiss and of hornblende schist. At Zubburkat, the rock is a gneiss, of a fibrous columnar structure, dark grey colour, and earthy aspect. It probably contains, if not hornblende, some magnesia or a mineral, probably talc or chlorite. It also contains grains of the blue semi-transparent mineral noticed (Art. 139.) Beyond this village immense blocks of a well defined gneiss are met with, resting on the mountain side, and some few of hornblende rock, but such is the thickness of the covering of debris and vegetable mould, this being the side of easy slope or quarter of the dip, that no instance of the rock in situ occurs till we approach the village of Chelinga; here may be seen a strata of gneiss, dipping N. 85° E. and at an angle of 40°. This gneiss agrees in character with that constituting the large blocks just noticed, and has an affinity to that seen at Zubburkat. It is a small granular mixture of black mica, greyish white felspar, and quartz, with distinct foliated grains of felspar superadded. The quartz is obscure, and indeed in all these mixtures of small grain, it is not easy to detect the nature of ingredients

so intimately mixed, without using some method of mechanical analysis, similar to that proposed by M. Cordier.

150. In the ascent from the village of Chelinga to the Goruldum Pass, no rock in situ is visible, but fragments of granite occur, of various sizes, strewed over a small flat at the commencement of the ascent. The source of these is not obvious. On the summit of the Pass quartz rock and chloritic schist, passing into micaceous schist are found in strata, the dip of which is a little obscure, but which seemed to be N. 60° W. Of the quartz rock, it is doubtful, whether it be not a transported block, but the schist is evidently in its place. On leaving the Pass in the descent to the village of Koolem, an earthy decomposing granite in amorphous patches is met with, of the same character as that noticed above Baree, in the valley of the Mundaknee, (Art. 100.) This rock is a very remarkable one, and requires a little detailed description. The proportión of felspar compared to that of the other ingredients is very great, and it appears to be singularly subject to decomposition, so much so, that the rock may be dug like a bed of clay or vegetable mould; the quartz and felspar, on a first appearance, form one uniform mass, in which, however, they are to be distinguished by colour, the quartz being greyish white and the felspar yellowish, and by their state of disintegration. The mica is of a dirty brownish green colour, and is disposed rather irregularly, as well as scantily. The laminæ are never parallel, a character by which it has been proposed to distinguish granite from gneiss, and which if it hold universally, will form an useful distinction, as being easily recognised.

151. On descending into the valley described in Art. 149, no rock is visible for a considerable distance, the soil being of great depth, and frequently overspread with forests. In the beds of streams however, may be observed occasionally the edges of strata, both hornblende schist and gneiss, and there are several patches of the decomposing granite also. In the ascent from Hath to Retorah villages, gneiss may be observed, at first of a very regular character, bluish grey, and strongly resembling the most legitimate gneiss of the Himmalaya. The gneiss appears gradually to pass into micaceous schist, which at Retorah is white, fine granular, and almost might be called slaty quartz rock. On the summit of the Hackena Pass, which leads into the valley of the Cossillah, it is of a dark greenish brown colour, very micaceous, and very

tender. The dip of the rock at Retorah was irregular, and the gneiss in the neighbourhood equally so, the strata having many undulations, but the rock observed in the bottom of the valley had a dip N. W.

152. Descending from this Pass quartz rock of an arenaceous composition is found. It contains beds of chloritic schist. Beyond this, near Mala, argillaceous schist becomes established, of great variety of aspect, of a purplish, greenish and light grey colour, straight, fissile, with rhombhoidal cleavages, and of a soft consistence, comprising every variety almost of the brightest colours. It contains beds of limestone, which are often highly argillaceous. Farther down in the valley of the Cossillah, micaceous schist is met with, and then an extensive patch of gneiss, which stretches across the valley, and is probably connected with other masses shortly to be noticed. Afterwards the micaceous schist again re-establishes itself, and continues to Almorah. Here for the present we shall break off this description, and return to the route from Sacen, in which gneiss was traced as far as Nancik, and to the bed of the Ramgunga below the village, (Art. 106.)

153. The route proceeds by Ratik, gneiss accompanying us the whole way; some fragments of a very peculiar rock were found, composed wholly of a substance which might be called intermediate in character between rhombohedral and prismatic talc mica. It was of a dark brownish green colour, and the foliæ of the mineral were placed in every direction, having the appearance of a confused aggregation. The same rock occurs rather abundantly in the ascent to the Soor Doora Pass, but always in fragments, while the rock in situ continues to be gneiss as far as the village of Soor. Beds of hornblende schist, and of micaceous schist occur in the descent to the bed of the Sirjoo river; the gneiss being, however, the containing rock, and continuing to some distance beyond the village of Soope.

154. Here the rock begins to change, the gneiss appearing to pass into a fine grained mixture of talc and quartz, which may also perhaps contain felspar. This is succeeded by quartz rock, which again becomes talcose, and incloses small beds of talcose schist. It passes into chloritic schist also, the quartz becoming at first green. The latter rock contains veins of quartz, and on one a particular concretion of so remarkable a shape and appearance, as to have the strongest resemblance to a rib-bone. In endeavouring to detach it, the resemblance was des-

troyed by fracture. On the Pass of Chowr Bunaik, the talcose rock is fairly established, being occasionally schistose, occasionally amorphous or massive. It is of a white colour and beautiful nacreous lustre. Descending thence, various mixtures of this mineral, (prismatic talc mica,) with quartz, are found sometimes inclining to a green colour, and apparently allied to chloritic schist, sometimes to a blue, and passing into argillaceous schist. Alternating beds of the green schist and quartz rock were observed, very regular and well-defined.

155. In the neighbourhood of the village of Kurrimee, the rock is a mixture of white granular dolomite and talc. The latter is sometimes found in beautiful nacreous scales, disposed in nests or nodules, at other times intimately mixed with the particles of the dolomite. In the latter case, the rock is extremely friable, and resembles very strongly the dolomite of the Alps. This rock is succeeded by a schist of an argillaceous character, very soft and tender, and of a dark blackish grey colour. The schist is occasionally green in the ascent to Tobne Binag, where the view of the mountains discloses several beds of talcose schist of a whitish colour; descending to the village Bugur in the bottom of the glen, limestone is the rock. It is often very impure, being highly charged with argillaceous or siliceous matter. It is regularly stratified, dipping N. 48° E. at an angle of 60°. The strata are sometimes curved.

156. This limestone continues in the ascent to the high Pass of Cheeoonga Binag, the whole of which ridge is composed of it. With occasional patches of schist of an argillaceous character, it still accompanies us by the village of Ingthana to Bynsaree, in the route down the glen in which those villages are situated. The strata are sometimes fissured and cracked in every direction, and in some cases so fragmentary, that large masses have fallen out, thus giving rise to extensive caves. From Bynsaree, the route passes up a lateral glen to Soomchala, crossing an elevated ridge. On this ridge and the immediate ascent to it, argillaceous schist is found of a reddish brown colour, earthy composition, and splitting readily into rhombohedral fragments. This rock is sufficiently exposed also in the descent to Soomchala, where it is remarkable for its many changes of colour, within a small space; as also for the rhombohedral cleavages passing into the straight schistose.

157. As far as Darimket, the route lies in a succession of glens, in which no trace can be found of the rock in situ at that village. It ascends, and immediately a talco-micaceous schist is met which continues to the foot of the descent into the valley on the other side. This latter is one of the many branches which fall into the great one of the Gaomootee, described, Art. 65, and as such, partakes of the open and level nature of the latter. At the foot of the descent fragments of hornblende rock occur in great abundance, and a little further, the rock in situ is found to be an earthy gneiss, extremely soft and crumbly. This rock continues to disclose itself in different parts of the river bed as far as Byznoth; and at the foot of the ascent to Retora a grey gneiss of very perfect character is seen dipping N. E. In the ascent to Retora, this route coincides with that described Art. 65.

158. We have now to take up our account of the gneiss at the village of Dampa, Art. 105 where it is described as of a remarkably regular type, and disclosing itself in extensive masses distinctly stratified. From Dampa to Munsaree, this rock continues, and near the latter place and above it, are enormous blocks of this rock scattered about in the wildest confusion. Thence ascending to the Betoolee Dhoorah Pass, the same rock is occasionally found, and occasionally beds of hornblende schist. At Munsaree there occurs a bed of a very beautiful rock, being a mixture of white granular limestone and talc, (prismatic talc mica,) the latter is occasionally diffuse. Amongst this the carbonate of lime occasionally occupies distinct layers, passing into the argillaceous schist. This rock furnishes excellent roof slate, being very fissile. In the bed of the Gurjeea river below Munsaree, the rock is an earthy brown, tender, micaceous schist in descending the bed of the Gurjeea, as succeeding to the gneiss.

159. Descending from this Pass, quartz rock occurs in extensive masses distinctly stratified, dipping N. 15° E. Other fissures at right angles, at distances of five feet, are extremely distinct, the whole mass being thus divided into rhombohedral or cuboidal masses. This quartz rock is seen sometimes plain, sometimes green from the addition of chlorite, and sometimes blue, probably from an admixture of argillaceous schist. On the Kalee Moonnee Pass and the descent to Girgaon, the rocks are rather of an anomalous nature, and comprise beds of very various and varying composition. Talc slate, yellow, white and blue

carburetted clay slate, blue ditto, talcose quartz rock, and talcose limestone are the most marked types, and they succeed each other in the most sudden and unexpected manner. In general, however, the formation may be said to have a talcose character, that mineral forming more or less of the composition of each rock, but I think that it is surmounted, or at least surrounded, by the same gneiss which accompanied us from Munsaree, and which appears in all the larger masses and the more elevated ridges. In the bed of the nullah below the village, rounded blocks of this rock are seen of an enormous size, which confirm the above idea. Beyond this point, it is not found till we approach Almorah, and the masses in that neighbourhood being connected with the granite beds there, will be better described when we come to the details of the latter.

160. The preceding comprises all my observations of the localities of gneiss within these mountains, with some trifling exceptions hereafter to be noticed. It will now be necessary to proceed to the next formation in the order of succession. It is of a schistose structure, but very variable in mineral character, comprising micaceous chlorite, talcose, and even argillaceous schist. My observations are not yet sufficiently multiplied to determine, whether all those schists form one member in the succession of rocks, or whether the three first are to be considered as most intimately related, and the argillaceous band as the distinct term in the geological series. Some anomalous appearances, which are inimical to the latter view, may perhaps be explained by the intrusion of the granite masses in the middle of argillaceous strata, but it would be premature at present to decide either way. We may for the more convenience of description, consider them all as members of the same formation, as each in its turn is conterminous with the gneiss.

161. Beginning with the most western route, we may take up the description where the micaceous schist in succession to gneiss was again exchanged for chlorite schist. Near Laké, the latter rock may be seen, though from its transitions it ought perhaps rather be called a magnesian clay slate, (talco-argillaceous schist.) It has a N. E. dip. It extends to the foot of the descent into the bed of the Salung river. There may be seen an impure limestone associated with a clay slate, the two rocks being found not only in alternate layers, but also occasionally intimately mixed in the same layer. The fragments in

the bed of this river consist of granite, gneiss, micaceous schist, and hornblende rock, all of them substances at present found in situ only at a considerable distance.

162. Ascending to Reowthul, numerous indications are observed of a limestone formation; clay slate does not entirely disappear, but the higher ridges in the neighbourhood, judging by the outline and general appearance, are evidently limestone. This rock affords one of the instances in these mountans in which disposition of form and colour is an unerring guide to the nature of the rock, forming a series of irregular terraces or ledges, the faces of which are always precipitous, and stained with black and yellow, the outline of the summit presenting a rather flat curve; it is impossible to confound the limestone of these mountains with any other rock. There is certainly a local physiognomy in rocks, if I may so express myself, which enables a person familiar with them, frequently to determine correctly their nature, from the mere view of the mountains in which they are formed. But there is no truth in the opinion that would extend these local phenomena to a wider sphere, so as to make them instances of a general law.

163. At Reowthul, there are several smelting houses for obtaining iron from a hydrated peroxide, (prismatic iron ore,) which is found in the neighbourhood. I had not time to visit the place whence the ore is obtained, but I examined the specimens of it which they had brought for smelting. It is a light scoriaceous yellowish brown crust, and very similar to deposits of the same ore which I have seen in other localities as originating in streams, permeating argillaceous schist, and strongly charged with ferruginous matter. The iron is said to be in repute.

164. From this village the route passes round the brow of the range to the Pass immediately above Surara, and in this line wherever the rock is seen it would appear to be limestone, with some trifling exception in the occurrence of a micaceous argillaceous schist. At Surara again, the rocks are all limestone, presenting that appearance so common to this class, of huge amorphous masses united to others often honeycombed or irregularly varied in surface or regularly stratified, or even schistose. Yet I would say on a large view of the phenomena, that this rock seems to be always most regularly stratified when most impure, and vice versa. Another appearance remarkable in this limestone is the aries

that seems to attack lumps small of it, changing the outer surface to the colour, grain, and consistence of chalk. This change is the more remarkable in a rock, which like this is of a blue colour, and possessed of considerable hardness.

165. In the descent from Surara to the bed of the Syrij river, limestone is the only rock seen, ascending thence to the ridge which forms the right bank the same rock prevails of a less pure type, and occasionally of a schistose structure. In the lateral glen in which the village of Ureea is situated, the rock appears to be mica slate, or a transition between that and clay slate; the limestone is in general impure; when otherwise, it appears to undergo that superficial caries already noticed. It must be rather an extensive bed, for most of the surrounding ridges were also observed to be composed of this rock, as recognised in its characteristic ledgy precipices. This limestone is also seen in the descent to the Bangur, and also in the bed of that nullah, distinctly stratified and dipping N. E., the reverse of the micaceous argillaceous schist near Ureea, which is S. W.

166. On ascending from the bed of the Bangur, an anomalous rock is seen, in amorphous patches of a greenish colour and considerable hardness, very possibly ferruginous quartz rock. A black type of the same rock occurs in fragments in the bed of the nullah, and with disseminated iron pyrites, (rhombohedral iron pyrites,) argillaceous schist then establishes itself, being occasionally of a magnesian character; occasionally (below Sookowlee,) of a micaceous. The route here passes over the several ridges which ramify from the Chandpoor peak, the rock of which is micaceous schist, and this line appears to be the junction of the two formations, to judge by the frequent transitions and oscillations. It may be observed, that the strata appeared pretty regular, and with exception of the rock at Ureea, appeared to dip conformably.

167. In the vicinity of Sokanda, the schist assumes a micaceous character. Near Dharee, limestone protrudes in limited quantity, and we have then the argillaceous schist with its usual variableness of character continuing to the bridge over the Tonse at Mywar. It is at one time a blue smooth laminar slate, (talc argillaceous schist,) again a fine grained slate approaching to compact (argillaceous schist,) which is succeeded by a fine grained greywacke, slate (micaceous

argillaceous schist). Just above the bridge, nodules of limestone are seen, but the rock appears to have no extent.

168. In the bed of the river, a very perfect type of argillaceous schist is seen, distinctly stratified, and dipping conformably. It passes into a rock, having the strongest resemblance to reunited angular debris. It is in this rock that the Uyar lead mines are situated. The rock is so soft, as to afford great facilities in excavation, but unless well supported by wooden framing, it is liable to the accident of falling; has happened more than once, and several miners have been crushed. The ore is a steel grey fine granular galena, (hexahedral lead glance,) and is often found in veins traversing quartz; it is accompanied by iron pyrites, (rhombohedral iron pyrites.)

169. At this place the river is crossed by a bridge formed of a single rope, on which a block with the passenger or baggage attached, traverses. It is a very tedious, though perfectly safe method of crossing a river. On the right bank about one and a half mile lower down is the lead mine of Mywar, belonging to Tounsar, one of the reserved districts. That at Uyar belongs to Sirmoor. At Mywar, the same ore is found and accompanied by the same minerals, and the containing rock is there also a clay slate, though occasionally very calcareous. The galleries are very numerous; in some, sulphur is obtained. In others, the vein is a blackish friable earth, in which the galena is in nodules.

170. The route to Borrela from this place turns back to the northward, ascending along the right bank of the river. In crossing the Ventijar, which here falls in the Tonse, argillaceous schist is seen in its bed in situ, while the round stones are all limestone. These boulders continue to the height of 300 feet above the bed of the river, and are united with a calcareous conglomerate, which is, however, of a very limited extent. Argillaceous schist is thence the prevailing rock, but mixed with occasional patches of limestone; above the village of Joktan the latter rock establishes itself in larger masses, constituting whole ridges, and extending with very little interruption thence to Borela.

171. It is in this rock, which in its lower strata appears to pass into argillaceous schist, that the lead mines of Borela are situated. The ore is in every respect similar to that found at Uyar and Mywar, and is also accompanied as there, by iron pyrites. The number of galleries here, as well as at Mywar, is truly surprising, and shews the perseverance of

these people, even with their imperfect means. They told me they were in number eighty, many of them of great length, and yet the village is small, and does not contain above forty inhabitants of every sex and age; but there are several other villages that have a joint proprietary right, the assessment being made on the small purgunnahs or hundreds, as they might be called, and not on the individual villages.

172. The limestone of Borela continues to Haje, with very little interruption, and through a varying level of at least 1,500 feet. It very often contains veins of a pure white calcareous spar, sometimes it is fœtid, and then it always appears to be less pure. In this latter case, it is occasionally found to contain veins of white granular limestone, and not unfrequently also, to pass into a flint slate or schist. It has its subordinate and limited masses of local breccia, and conglomerate accompaniments, which this rock is never seen to want. It is a good deal intermixed with quartz rock, and has occasionally, as might be expected, a silicious character. With regard to its stratification, it is when at all impure, distinctly marked by parallel seams, and when pure, as often amorphous. This indeed is a remark I think universally applicable to limestone. A very remarkable curvature of the strata is seen on the ascent from the Mator nullah, which separates Haje from Borela; some indications of argillaceous schist were also observed here.

173. Near Haje, the rock may be called a well characterised argillaceous schist, which afterwards becomes micaceous. This is succeeded by a series of types of quartz rock of very various character. The most remarkable feature in this rock is the suite of colours it exhibits: grey, green, red, purple, and brown from the extreme shades, and in their transitions, a great variety of intermediate tints are produced. In general, it has a granular composition with considerable hardness. The structure is occasionally cleavable in three or more directions, occasionally it is subschistose. In the latter case, the rock is observed to pass into an argillaceous schist. In general, this quartz rock owes it colours to indurated clay, or a basis of clay slate, and it contains, superadded to this ingredient, scales of mica, never in any abundance. The composition is never of that decidedly granular appearance which distinguishes the sandstones; frequently it is evanescent where the proportion of quartz is a little less predominant. I think this rock might

be considered as a greywacke; some of its transitions into argillaceous schist are doubtless entitled to that designation.

174. On the border of this rock, we find another of so anomalous a character, as to require some illustration from investigations in other parts of the line of strata. It consists principally of indurated clay and quartz, and contains grains of a green pellucid mineral, very much resembling some varieties of actynolite. It also contains mica in notable proportion. It is in fact one of the many aspects under which the above described quartz rock is found to vanish. I have sometimes thought that this rock has some connection with one occurring on the road from Bheemtal to Almorah, and which will be afterwards described. Like this, it is connected on the one side with quartz rock, on the other with clay slate. In this quartz it is succeeded by a small patch of slaty limestone, which speedily gives way to the prevailing rock of distinct argillaceous schist.

175. This schist presents a great variety of types, as may be seen on the road to Deao. It is sometimes compact, sometimes granular, often heterogeneous in composition. The granular types are seldom perfectly fissile, some not at all. In those which are so, the laminæ are almost always undulated. It is further remarkable for the quartz veins by which it is intersected in every direction, not only in that parallel with the laminæ of the schist, but also transversely, and in every possible angle of obliquity. These veins, as has been often remarked, never appear to interfere with, or disturb the arrangement of the parallel layers. In one instance, where dip has occurred, a bed of local debris (alluvium of descent) of fifty feet in thickness is observed resting on a highly carburetted type. It is not improbable, from this and other indications formerly observed, that graphite exists in this neighbourhood. I ought not to omit noticing, that the dip wherever observable was between N. and E.

176. This schist continues in the descent to Kalsee, and under such protean aspects, as renders the study of its relations extremely interesting. It is at one time a green slate, with smooth laminæ, which by a gradual change, passes into a rock, that in hand specimens could not be distinguished from a greenstone. The transitions into this rock are remarkable for affecting a rombohedral cleavage. Within a few yards it again appears as a shattered slate, consisting of very thin and scarcely

adhering plates confusedly united, as if they had been crushed, or at least suffered some violent pressure. The ordinary type is seen to pass into a veined one, the veins being quartz, and this gradually into a quartz rock of a dark colour, highly charged with the indurated clay of the slate, and still intersected, as that was, by veins of pure quartz. The laminæ of the most perfect slaty varieties are very often bent; small patches of limestone, evidently the traces of included beds, occur along the whole line.

177. At Kulsee, the rock is still argillaceous schist of a very perfect type, dipping E. of N., that is, at the bungalow belonging to Major Young on the hill; but in the descent to, and in the town, the rock in situ is concealed, and it is not till after having passed it a mile or so, that a new formation (sandstone) is observed to be established. The strata dip S., and a little further on, are vertical. From this position they gradually passes to a dip E. of N., but possess still a high inclination. The character of the rock is perfect, and leaves no doubt that the argillaceous schist has here terminated, and is succeded by a totally different formation. I shall therefore defer my details of the new rock till I follow out all the details of the former one, and trace it in a similar manner to its boundary in every other quarter in which it has been examined.

178. I shall take up my description at the point below the village of Kande in the Burral district, where the last patch of gneiss was found, (Art. 139). It was noticed that the ridges above appeared, by their outline and arrangement, to be limestone; a few traces may also be seen in the bed of the stream, and fragments of the local conglomerate which always accompanies limestone. The rock then becomes a talco-argillaceous schist, being frequently distinguished for its beautiful pearly lustre and pleasing colours. This type is further remarkable for its smooth gently curved laminæ, and the minute undulations or furrows of their surface. These latter I have almost invariably observed in slate that contains a sensible proportion of magnesia. Besides this well marked variety, there occurs another of an earthy character, which gradually passes into hornblendic schist.

180. The dip of the strata in this glen, (Burral,) was uniformly W. and N. W., and therefore not conformably to what I suppose the general dip of the formations throughout these mountains. Nor is it an

irregularity confined to a small extent of country, for the surrounding ridges and peaks are all obviously conformable in dip to that observed in the valley itself. In the Rama Sera glen again, it was observed to be,* which is something more approaching to the usual dip. In this case the principal effect due to the disturbance of the strata, (if they really be disturbed,) would be found in the Burral glen. It is to be observed, that both the Burral and Comoulda rivers spring from the furrows which intersect the sides of the great Kedarkanta peak elevated — ? feet. This peak is remarkable for its shape, and for the arrangement observable on the summit. The shape is that of an immense truncated cone, which appears to have an oblique position, owing to its greater slope on one side, and precipice on the other; the summit is flat and of some extent; at one end is a considerable hollow, in which are wedged together, in utter confusion, enormous blocks of gneiss, the rock of which the mountain consists. The strata appear to dip N. W. What connection the peculiar character of this peak (if any) may have with the irregularity of the dip, it would be vain to enquire without a more detailed examination of the vicinity.

181. At the mouth of the Burral glen is an extensive flat, communicating with a similar one in the valley of the Jumna, and very little higher than the present level of the latter. It is observed to terminate in the bed of the Jumna in smooth rounded elevations, which on the river side are cut down vertically, and exhibit, in the precipice facing the river, their structure in the most complete manner. This precipice is about 120 feet high, and is composed of loose gravel and sand, with numerous round stones of every size sticking in it, some of them half projecting. On the opposite side of the river appears a similiar bank, composed of similiar appearances, and of the same height. The intermediate space, to judge by local appearances, must have been once filled up; for so narrow is the gorge, that no possible slope at which they could lie would clear them of the river bed. Indeed, the one is washed by the waters of it, and at the foot of the other, the path is not more than a few feet wide.

182. The right bank sinks, as I have said, gradually into the broad and level flat at the mouth of the Burral glen, the slope being, like the latter, covered with verdure. The left bank continues of moderate

* Blank in MSS.

width to a point below the affluence of the Burral, and then gradually subsides about half a mile. Below this point occurs a third similar flat, doubtless composed of the same materials, and containing about half a square mile of level ground. It is worthy of remark, that the three are, as nearly as the eye can judge, of the same level. It should also be noted, that in the two, the structure of which appear, nothing like strata or a division, nor distinction of deposits occurs; the great and small boulders are indiscriminately mixed in every part, and the whole has the appearance of being the effect of some very powerful, but sudden or short-lived cause. The fragments most abounding are quartz rock of all colours, next to this is hornblende schist, with very few of granite or gneiss.

183. The last rock observed in the Burral glen was a blue talco-argillaceous schist, with a pearly lustre. In the bed of the Jumna, close by the suspension bridge, a mass of limestone occurs. On crossing the river, a rock of limited extent is met with, and of very anomalous character. It is probably a mixture of chlorite quartz and felspar, the latter not abundant, or the green ingredient may be some variety of hornblende. The structure appears to be laminar, yet the fracture is such as to indicate the amorphous. It is a tough rock, and breaks with sharp corners. It is succeeded by extensive strata of a talco-argillaceous schist, the prevailing colour of which is an olive brown. The dip appears to be N. W. the same as that in the Burral glen,

184. From Burket to Bimsa, the prevailing rock is chloritic schist, often inclining to argillaceous, often soft and decomposing, intermixed with beds of quartz rock which generally incline to a green colour. The earthy, or decomposing and the more perfect straight laminar types, are often found in the compass of a few feet, nor can there be any doubt of the unity of this formation when we view it in nature; although a collection of the specimens, unless extremely numerous, might exhibit some very striking contrast. Frequently, the laminæ are extremely thin, quite flaky, and in this case they are seldom separable of any size. From such a rock, it is impossible to detach a specimen, for on the application of the hammer it flies into showers. When the colour inclines to green this rock is generally soft, when to blue it is hard. No good examples of strata are met with on this line, the rock seldom appearing but in surface patches of no great extent.

185. From Bimsa the road ascends a lateral ridge, and thence descending upon the village of Tevan, crosses the Bunnee glen near Kateel. On the summit of the ridge, or rather just below it, there is an exposure of the rock, (in a space little exceeding ten square yards,) of the following very dissimilar substances :— 1. a light bluish grey mixture of talco-argillaceous schist and quartz, this changes to, 2. a more perfect schist, with bent laminæ, the colour still bluish or grey, the aspect a little talcose ; 3. a true chloritic schist, with similar bent laminæ ; 4. a dull green earthy compound without lustre, has a subconchoidal and uneven fracture, splits into thick flags, and is subcleaveable ; it is probably a mixture of hornblende and felspar, or of chlorite and felspar, or possibly all three ; 5. a light bluish green talcose schist, with curved and straight laminæ and considerable lustre. These types will also serve for a description of the rock as far as the ford over the river, occurring in various propositions and successions, which it would be a waste of time to attempt to devolve, the whole being united in the clearest manner, and constituting but one formation.

186. The ridge just crossed in its prolongation, puts on the appearance of the limestone precipice described, Art. 181, and on crossing the Bunnee river, there is little doubt but that these appearances are indicative of a limestone bed. It continues for about two miles, when argillaceous schist establishes itself, extending over the Gooddur Kuttal Pass to Moolla, a small village in the Gooddur glen. This schist is certainly not at all talcose in its aspect. It is of a fine granular or earthy composition, is very soft, and is remarkable for splitting into prisms, not laminæ or slates. They are sometimes of considerable length, slightly flexible, and would form very excellent slate pencils. It is of a great variety of colours, black, bluish, greenish, yellowish, olive brown, reddish, &c. &c. It contains numerous beds and veins of quartz. Below the village of Moolla, it passes into, or is replaced by a true chlorite, dipping N. W. with an inclination of 35°.

187. From Moolla to Horinsee, the argillaceous schist prevails, none of a chloritic character being visible. Close by the latter village, there is a mass of rock deserving of examination. It appears to be in one spot of a fine blackish greywacke schist, with scales of mica disseminated; the composition fine granular, the structure well marked schistose. It is in contact with, and passes into a reddish brown rock of

coarser composition, with a structure amorphous, or at least only subschistose. Adjoining the latter, a greenish grey rock of fine granular composition, the structure entirely amorphous, and having a high specific gravity; consequently containing either hornblende or augite. The three types are all included in a single mass of no great extent, and on passing them, argillaceous schist of the usual character is found.

188. From Horensee, the route passes down the Bhudree glen, which is of some width, and encloses a good deal of level ground. In consequence, the rock is not often visible. Close to the village of Kol, there is a sudden descent, in which strata of schist appear intermediate in character between argillaceous and micaceous schist. It is accompanied by quartz rock, which as usual, forms a series of transitions into the schist. A little beyond Koree, a pale bluish grey subschistose rock, a composition probably of indurated clay and quartz rock, comes to the surface. It is succeeded by a dark blue argillaceous schist, containing nodules of quartz, the laminæ of the slate being bent round them; a bluish grey rock of a subschistose structure, not very quartzose, becomes then established. If it were not that it wants the decided appearance of a mechanical origin, I should feel strongly inclined to call this a greywacke. But the erroneous application of the latter name is the more to be guarded against, since it has become certain, that some of the rocks which have been distinguished by this appellation, are identical with the red sandstone, a rock of which no trace is found in this quarter. Under the title of argillaceous schist and quartz rock; it cannot lead to any false conclusions, and as such, it may be described until our nomenclature of rocks be more discriminative of them than it is likely for a long time to be.

189. It continues as far as Koodæon in the valley of the Aglar, forming the whole of the ridge which separates the Bhudree glen. In the bed of the Aglar, a very similar rock prevails, but on the ascent it acquires the more characteristic aspect of a true clay slate. Infaceous conglomerate is also seen in isolated masses, and occasionally a blue limestone. Near the village of Ramon, the latter rock becomes established, to the exclusion of the slate. It is, however, of very various aspects, sometimes it is a black, hard, non-effervescent rock, fœtid when struck, and possessing scarcely any resemblance to limestone. This is its condition generally in the vicinity of the masses of gypsum which are here found; at other times it is highly siliceous, and though bearing

the appearance of limestone, might from its non-effervescence, be called schist; the pure blue limestone is, however, also found, and in considerable quantity.

190. The gypsum which is associated with this limestone, is of a saccharoidal aspect, the colour being beautifully white, and the grain fine. No crystals, except the most minute, have been observed. It is found neither in beds or veins, but in superficial amorphous patches, presenting an appearance of considerable singularity and interest. It is always connected with the black non-effervescent rock described in the preceding paragraph. The latter has very often the appearance of reunited fragments, and the gypsum sometimes contains nodules of it. Without doubt some connection exists between the origin, or at least the present place, of this gypsum and this very singular rock, always found in contact with the former, and not observed hitherto anywhere but in the immediate vicinity of it. There is not the slightest appearance of stratification in either rock.

191. From Ranon to the summit of the ridge, (Mussooree Tuba,) limestone prevails, and the varied and picturesque disposition of this mountain sufficiently attests the character of the rock. In all countries it has been observed, that not only are the limestone districts most fertile and productive under the labours of agriculture, but that also when abandoned to the hand of nature, they furnish the most picturesque and beautiful scenery. The summit is composed of the same rock, and constitutes one of the most romantic spots within the circuit of the mountains.

192. Advantage has been taken of the elevation, and the consequent coolness of the climate, to establish a nursery garden at Saharunpore. This is intended for the purpose of naturalising the more hardy plants of the interior, that otherwise would languish and die, under the fervors of a tropical sun if too suddenly transplanted. It promises to be eminently successful, though as it had only been just begun when I visited it, this opinion must rest on other grounds than experience; no doubt a favorable feature in the plan, though accidental, and not a disposing reason for the original choice, is the nature of the rock; the argillaceous and micaceous schists, the only rocks besides limestone from which the selection lay, furnishing a very poor and meagre soil for almost every description of produce.

193. From the garden, the road descends obliquely along the face of the range to the village of Juree Panee, in this line the limestone is lost almost immediately, and argillaceous schists succeed. They are of various colours, many of them very bright, red, yellow, green, grey, olive brown, purple, &c. This change of colour is characteristic of this rock, which is further remarkable for its different degrees of consistence, being at one time soft and diffusible in water like clay, at others hard, and though not furnishing good roofing slate, yet very similar in mineralogical character to that substance.

194. At Juree Panee, limestone again appears, but in small quantity; some specimens were observed of it containing veins of fibrous gypsum. These were of the most regular type, and had no resemblance to the black scoriaceous rock before noticed, as associated with the gypsum near Ranon. The argillaceous schist again establishes itself, and continues to Rajpoor at the foot of the descent. In this line it is rather harder, in general, than that above described, and inclines more to blue, purple, and green colours. It contains masses of quartz rock often strongly impregnated with the matter of the slate. At the foot of the descent, the structure appears to change to that already described Art. 184, as consisting of thin foliæ or leaves scarcely adhering, and of very limited size.

195. The mountains which bound the Doon to the north, and which stretch from the Jumna to the Ganges, are all composed of argillaceous schist. Beds of limestone occur similar to those already described, but never of any great extent. Gypsum also similar to that at Ranon is found, and under similar relations at two other places, and it is probable, will be eventually discovered at many more. In the bed of the stream in which the Sunsar Dhora, or Dripping Cave, is situated, and about a mile higher up, may be seen the remains of a very large bed of this substance, the greater part having been removed by quarrying. It lies in the same kind of superficial amorphous mass, and is associated with the same fœtid anomalous black rock as at Ranon. There are two varieties which lie in contact, and between which, a kind of transition takes place. The one is of a beautiful saccharoidal aspect, of a snowy white colour and fine granular composition. The other is of a dirty white colour, approaching to yellowish grey, and the composition is finer, almost impalpable; nor are the minute crystals discoverable in

it, which may be seen to constitute the grain of the other, being in fact dull and earthy, like chalk. It is the more abundant of the two, and indeed may be had in almost any quantity. It would probably answer for the preparation of plaster of Paris, though certainly not for statuary.

196. The other locality is in the bed of a small nullah, which falls into that in which the Dripping Cave is situated. There are some springs in the bed of this stream, which have a strong odour of sulphuretted hydrogen, and I should notice that the water of almost all these streams deposits carbonate of lime. The gypsum at this locality was described to me as forming a mass incumbent on clay slate, and not in contact with either limestone or the black rock so often mentioned. This mass had a flattened form, and might be called a bed; a perpendicular fissure in the slate was filled with gypsum continuous with the upper mass, thus giving the idea of a deposit. In my attempts to find the place I was not successful, but I met with many loose masses, and some of rather impure appearance, entangled with the angular debris which had rotted from above, and settled into banks of different heights at the foot of the mountains. It was associated in such a manner, as to leave no doubt that it had been in a state of fluidity when it assumed its place there, and thus we might pronounce with some certainty on the comparative ages of these masses of gypsum, which in this instance at least must have been posterior to the formation of this local debris.

197. We have now again descended to the Doon, where a totally different order of things prevails. It may be useful before proceeding to the Eastward, to notice different detached points at which the same formation of argillaceous schist has been observed. At Riki Khes and along the banks of the Ganges, as far as Deoprag, no other rock is seen. In the route too from Dehra to Teeree, the residence of the Gurhwal Raja, it equally prevails, the several types corresponding accurately to those already described. In particular may be seen the soft variety of various bright colours in the ascent from the village of Manjgaon in Sikimana pergunnah. Excellent roofing slate is general throughout this quarter, nor are the houses ever covered with any other materials; along the whole valley of the Aglar, it was equally general, occasionally presenting however a patch of limestone. The Byrath range, which

shuts in the Umloo, is also composed of it, frequently containing beds of quartz rock. In the valley of the Tonse, argillaceous schist is traced as high as the village of Kande. In the route from Calree to Jytull, little other rock is seen excepting limestone, which in the neighbourhood of Kangra is abundant.

198. From Jytull again to Subhattoo, the road, passing along the summit of a ridge, carries with it, the whole way, argillaceous schist. In this tract, no limestone beds are found, but quartz rock is common from Subhattoo to Bar; in descending to the plains the same rock continues. In passing to the north road to Kotgurh, it is equally constant, at least as far as Lunla; how much further it continues in that direction, or where the junction with the mica slate takes place, I have no means of judging. From Subhattoo to Joonug, the residence of the Ranee of Kyoontal, it is equally constant, and extends probably much further. In the route from Nahun to the Choor mountain, clay slate prevails to within a very short distance of the latter, containing extensive beds of limestone, which in detached masses stretch along the crest of the Sacen range, dividing the valley of the Girree from that of the Jullal; connected with their beds are probably the masses which form the summits of the Rajgurh and Krol mountains; at the feet of these the schist reappears, continuing to extend as far as Subhattoo. Finally, the valley of the Sutlej between Koomharsen (or a little below it) and Soonee contains this formation.

199. It is time now to return to our details on the Kedarnath road, which were broken off at Almorah, (Art. 152.) At that place we have seen micaceous schist is the rock. But the details of it I shall postpone for the present, to trace out the limits and relations of the argillaceous schist in descending to the plains. There are two routes in which these have been examined, the Pass by Chilkeea, and that by Bhumooree. In the first of these, micaceous schist extends a few miles south of Turkhet, the second stage in the route from Hawal Bagh to Chilkeea. Between Turkhet and Pepul Point, it is gradually exchanged for an argillaceous schist of peculiar character. It is occasionally quite soft, white, and talcose, being rather meagre than unctuous. The micaceous schist again makes its appearance after a short interval, and then a very fine-grained gneiss in the ascent to the Bukar Mundal Pass, on the summit of which is a dirty brown-coloured micaceous schist

of an arenaceous composition, which is succeeded by a magnesian clay slate accompanied by quartz rock. The former frequently contains patches of a soft white clay, which evidently originates in a decomposing talcose schist, as the latter occurs in contact with it.

200. The quartz rock is most abundant as we approach Peepul Point, and immediately above the place of encampment there occurs a set of appearances which I think deserve description. It is so seldom in these mountains, that we can trace the junction of two rocks, that no opportunity should be lost where it is accessible of recording the phenomena. Fig — will render the following description more intelligible; it is anomorphous rock, apparently one of the numerous types of argillaceous quartz rock. It is seamed in every direction, as this rock very often is, but exhibits no trace of stratification. C. which adjoins it, is perfectly distinct, the line of junction being strongly marked. It is a white arenaceous rock covered with brown spots, crumbly, and with little consistence, but feeling gritty in the mouth. It is probably quartz, or a mixture of quartz and felspar, and the iron-stained spots may arise from decomposing pyrites. It passes below into a tolerably hard rock. D. is a series of thin foliæ or leaves (they can hardly be called slates) of argillaceous schist, of a plumbaginous aspect; they are soft, and soil paper. The series in its progress upwards gradually diminishes in thickness till it disappears; it is a quartzose argillaceous schist, stratified distinctly, the strata lying parallel to the preceding, nearly vertical. This latter, like A, are types of the ordinary rock, which seems to oscillate just here, between quartz rock and argillaceous schist.

201. The character of the rock C. (I can hardly call it a vein,) affords strong promise of the existence of graphite in this quarter. This mineral belongs to formations of the earliest æra, as anthracite has been referred to the suppositious transition class, and coal to the æra of secondary rocks. It is remarkable too, that the deposit from which graphite of the best quality is procurable, and which indeed furnished nearly the whole civilized world with the variety used for pencils, that of Borrodale in Cumberland is situated in a clay slate on the border of primary mountains. There does, it is true, appear some doubts as to the real nature of this formation, for some insist that it comprises rocks of the trappean type; however this may be, it is not the less certain that argillaceous schist is known often to contain very valuable beds or veins of graphite.

202. From Peepul Point to Okuldoona, the route is in the bed of the Casilla river, the latter being crossed eleven times; every where it is full of the rounded stones so often noticed, and their accumulations are sometimes observed to attain a height of 150 feet even, above it. It may be stated, generally, that where the river bed, or valley is narrow, there they attain to the greatest height; and where sufficiently wide, the extent is greater, but their height less. What the depths of those accumulations in the immediate bed of the river are, I have no data to determine accurately, but there are several reasons for believing it to be very great. They seem to be all of a very uniform character, modifications of quartz rock, more or less impregnated with clay slate.

203. The rock in situ here is of a rather singular character, but it will be here afterwards seen, that it is found in many distant parts of these mountains. It is in fact a quartz rock, but contains talc instead of mica! The strata are very obscure, although it is traversed by numerous irregular seams. In one instance I observed a mass of clay slate of a lenticular shape, inclosed in it, the length of this included nodule was about 10 feet, the thickness one foot; something like transition was observed at the junction. This rock has a considerable extent in the stage to Ookul Doonga. It is succeeded by a black amorphous rock of almost impalpable composition, which is traversed by veins of quartz. This passes into a talco-argillaceous schist with thin laminæ, but so tender, that no specimens are obtainable. Quartz rock of an ordinary character next succeeds; the strata very irregular and contorted. It is of a reddish colour, and almost compact, and in mineralogical aspect strongly resembles the boulder stones found at the foot of the hills. Fragments of the talcose quartz rock which I have just noticed, and which is not seen in situ in the intermediate space, have been observed at Dhikoolee, a distance of at least 18 miles. This rock is so remarkable, as already noticed, that its fragments are recognised with the greatest certainty, and we are thus enabled to trace the course which these boulder stones took, as also to judge of the distance they were transported.

204. Ookul Doonga is situated on rather an extensive flat; the bed of the river is composed, as already noticed of these rounded, stones. The rock is not therefore visible for a distance of a mile and a half; it is then seen in the river bed, and has the character of a micaceous fine-grained sandstone, stratified distinctly, but not at all schistose, or at

least not readily fissile. The fracture is difficult to obtain, as it splits in various directions with a kind of cleavage, on the face of which it is difficult to discern the mineralogical structure; the strata are frequently curved, and the dip sometimes reversed. On it lies a rather thick bed of a rock of an argillaceous character, rather one of the shales than a schist. It is loose and unconsolidated, having the appearance of a soft and tender rock which had been crushed; nothing like marks of stratification are observable. Its colours are various, and with this shattered appearance, characteristic; i. e. green, white, black, purple, red, yellow, all of decided tone, and changing often within a limited space. On this lies the diluvian deposit of rounded stones and gravel, which notwithstanding all the inequalities of the ground, and they are great and numerous, has its upper surface perfectly even and almost level. It is to be remarked, that wherever these beds are visible in their lowest limit, they are always found resting on these shattered masses of shale, and never in any instance on the sandstone.

205. In this rock we take leave of the argillaceous strata which we have now to follow out in the route leading from Almorah to Bhumouree. The micaceous schist beds, the details of which, as before observed, we will postpone till we come to the description of the granite, continue beyond Powree, the first stage, to within a short distance of the halting place, Ramgur, on the summit of the Sohakatee Pass. It is exchanged for a very hard bluish grey rock, with much of the external aspect of limestone, but non-effervescent, or very rarely so, and in a low degree. It is marked with stripes of a darker colour, breaks with a sub-conchoidal fracture, the grain of which shews it to be a composed rock, but so small is it, that there is difficulty in determining precisely what are the ingredients. Mica and quartz are evident, and a dark mineral, which may be either indurated clay or hornblende; some specimens contain also carbonate of lime. It forms a lengthened mass in the micaceous schist, being observed to descend to the bed of the Ramgur, and rise on the opposite side, holding an oblique course across the valley for a considerable distance, which is easily traced, owing to the peculiar surface character of the rock. From all the characters of the mass I am very much inclined to consider it as a vein.

206. Below the Pass, we have a white schistose quartz rock of rather arenaceous composition. It may contain a small quantity of felspar.

In the bed of the Ramgur, the rock is of a light grey colour, with black specks disseminated. This rock evidently contains talc, (prismatic talc mica,) as well as quartz, and perhaps some felspar. Near the Bungalow, the character becomes more regularly that of gneiss, and at the foot of the ascent to the Ghagur, specimens are obtained which however, unlike the Himalaya gneiss, are yet equally entitled to the name, at least in the present state of our terminology. This gneiss which constitutes the whole of this range, at least in this quarter, is deserving of a detailed description.

207. This rock may be said to be characterised: 1. by its small proportion of felspar; 2. by the predominance of a talcose or argillaceous ingredient; 3. by the singular types under which it sometimes appears, or in other words, its transitions into very anomalous rocks. It is of a schistose rather than a slaty structure; has a talcose aspect, varying in colour from a greenish to a yellowish grey, soft though tough, and of the peculiar composition which entitles it to be called gneiss, though of so small a grain as to occasion the separate ingredients to be not always easily recognisable. Besides the felspar and talc, it contains quartz, and occasionally hornblende, (Hemi prismatic augite spar.) The two most singular types into which it passes are; 1, a white schistose rock, probably composed of talc quartz and felspar, and 2, a dull reddish brown amorphous rock of earthy composition, and of a cleavable structure. This passes into a harder type of a darker colour, which is equally remarkable for its cleavable structure, and want of the schistose. This latter is found on the summit of the Ghagur, and has all the appearance of a perfect greenstone.

208. Below the summit on the south side, the same talcose and schistose gneiss is again found as in the ascent from the north; but in the descent to Bheem Tal, it appears to pass into an argillaceous schist, which occasionally seems to oscillate towards hornblende rock. In the latter case, instead of being schistose, it is always cleavable, the joints of the cleavage being of a copper brown colour, and exhibiting no marks of the internal composition, which can only be observed in the cross fracture so difficult to obtain in this rock. At the Pass near Sumket, which may be considered as the foot of the Ghagur, a rock occurs very much resembling some greywackes. It is a granular mixture of quartz and clay slate. At Bheemtal, the cleavable rock is prevalent.

209. The strata of which the Ghagur is composed, dip very regularly, at some points varying between E. and N., the inclination generally small, though sometimes as high as 40°. The cleavable types are, if at all, very indistinctly stratified, but they are traversed by rents or cleavages in every direction. The two types may be seen everywhere passing into each other, nor can there be a doubt of their geological identity; yet it is impossible to have specimens of greater dissimilarity in mineralogical aspect than are furnished by these rocks, a proof, if it were wanting, of the mischief of adopting the geological relations of rocks as the basis of our classification.

210. Between Bheem Tal and Bhumouree, some interesting phenomena are to be observed. The rock continues to be in its general character an argillaceous schist; some specimens of a purple colour and very perfect type being procured a little below the former place. In the vicinity of this is seen a small amorphous mass of a tufaceous character, and dark greenish grey colour; and at no great distance again, a huge block of the most compact quartzose conglomerate. In this latter, the cement is of a hardness and compactness which rivals the imbedded portions. No other sample of this rock is seen, the mass is evidently not in situ, but there are no circumstances in the vicinity to give any clue to its origin.

211. In the bed of the Nullah, half way down, round blocks are seen of a greenstone, in which the crystals of hornblende, (Hemi prismatic augite spar,) are distinct. The specific gravity of this rock is 2.9. That of the purple slate is 2.58. The latter passes into a dark blackish rock of a fine grain, and less perfect schistose character, the specific gravity of which is 2.7. The determination of these evidently points it out as a transition between the greenstone and slate. Fragments of toadstone are found in the same neighbourhood, having the same, specific gravity of 2.7. These consist of a dark, greenish grey ground, with white oblong spots, occasioned probably by imbedded crystals of felspar. The base evidently contains hornblende or augite, but the composition is impalpable, and to appearance, even with a magnifier, homogenous.

212. A little below this a rock is found something resembling the transition between the greenstone and the schist, but of a lighter colour, it may probably be called a fine greywacke. It is distinctly

stratified, dipping 10° N. W., the angle of inclination being 44°. It gradually passes into a most perfect micaceous sandstone, which is found occasionally to contain small nodules of greenish grey clay. The transition is observed to a great advantage, as the whole of the strata are exposed, nor have I seen in any part of the mountains an appearance that more interested me.

213. A little below this, we descend to the Balleea Nuddie, where the sandstone is again found, and resting on it various coloured and shattered rocks, described in Art. 204. In the bed of the Nullah, the fragments are, some limestone, some clay slate of a hardness approaching to that of jasper, but the greater part quartz, more or less impure. Near the bridge may be seen blocks of the blackish amorphous rock before noticed, and which in one solitary instance has been observed to have a partially cavernous structure; some of the cavities being filled with a zeolite mineral, (Kouphone spar.) This rock certainly appears to pass into the purple argillaceous schist, but as so often remarked, access is wanting to the junction of the rocks in order to establish this fact with certainty.

214. In this vicinity, (a little below the Buleea Nuddie,) I picked up fragments of a perfect greenstone of a large grain, very similar in fact to that of a granite. The ingredients were compact felspar and quartz. I have never found any thing like this rock anywhere else, nor have I been able to trace it to its original site. Sandstone, irregularly mixed with conglomerate, then continues to Bhumouree, where also it is to be seen, (in the bed of the Nullah,) dipping to the North at an angle of about 25°. Bhumouree is situated at the foot of the hills, in the Bhabur or elevated part of the Teraee.

215. I must now return to a route, the details of which ought to have been given before the last two, but the omission is not one of any

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of the gneiss to very near the summit of the ——— Pass, below which it is replaced by chloritic schist: fragments of hornblendic schist being also very common. The former continues to near Pokree, occasionally giving place to talcose schist, occasionally to talcose quartz rock. Near some of the old galleries of the copper mines worked here, are beautiful specimens of an emerald green straight laminar slate with high

* MSS. defective.

lustre. It passes so gradually into talcose schist of the palest colour, as to leave no doubt of their being but coloured modifications of the same rock. In the rock in which the galleries at present worked are situated, a flesh coloured schist is found, of a mixture of talc and quartz. It passes into a subschistose rock of a similar composition, the latter ingredient being in greatest quantity; in fact a talcose quartz rock. This is exchanged a little lower for a dark olive green soft rock, of a schistose structure, but not laminar, the aspect of the fracture being scaly. I think it consists chiefly of hornblende.

216. The copper mines here are situated in the quartz or talc slate just described, a rock of so soft and tender a nature, as to form a very strong objection to the efficient working of them by its frequent failures in the different galleries. At the time I visited the place, they had all fallen in, and consequently no specimens of the ore were obtainable, except such as could be gleaned from the rubbish lying at the mouths of the several galleries. These pointed to vitreous copper, or the sulphuret, the richest ore known. Copper pyrites was also observed, and blue and green copper in small quantity; whether the ore is in the form of veins or beds, it is impossible to judge in the present state of things. The water which issues from the galleries has a specific gravity of ————, is impregnated with the sulphate, and deposits sulphate of copper on the stones over which it flows. These mines evidently have been very productive, to judge by the extent to which they have been worked.

217. On the ridge from which the descent to Boomot commences, micaceous, or perhaps rather an impure talcose schist occurs. It contains a good deal of quartz, below this a decided talcose schist appears, of a greenish hue. In the bed of the torrent, at the foot of the ridge, blocks are found of hornblende rock, containing pure hornblende in bundles of needles, and glassy actynolite, in contact with a reddish felspar. I did not, however, succeed in detaching any good specimens; some rolled pieces of hornblende were found, having the closest resemblance to charcoal, in all save specific gravity. In these, the apparent fibre was most commonly curved, the lustre always dull. The rock from hence to Boomot is entirely talcose, being either a granular mixture of talc and quartz, (talcose quartz rock,) which occasionally becomes quite soft, and disintegrating; oc-

casionally a perfect talcose schist, which oscillates, as the rock always does, towards chloritic schist. A granitic mixture of hornblende and quartz is also found in limited quantity, the type in fact of a greenstone.

218. At Boomot, which is situated on an extensive flat, we find the rounded stones so often described, the flat being entirely composed of them; the height above the river is 200 feet, and the extent considerable. The rock in situ is seen, however, at the third of the ascent, and it is chloritic schist, which appears on the other side to pass into greenstone slate. On the left bank a larger flat is seen, being upwards of two miles long, and half a mile, or more, wide in the broadest part. This is also composed of the same rounded stones; these beds can never have owed their origin to any body of water so limited in quantity as the present supplies of this river; and besides these table lands are in reality 200 feet above the present bed. There occurs here an appearance which is of considerable interest; there are two levels, and a considerable difference between them in height, the lower table being nearest to the river. This condition of things certainly reminds one of parallel roads, as they have been called, in some of the glens in Scotland. Similar appearances have been observed by Captain Hall in Chili. The resemblance is the more interesting, because I believe it is now a generally received opinion, that the latter owe their origin to the successive burstings of a lake, at distant intervals of time.

219. On crossing the suspension bridge, a rock very like greenstone slate is found, it passes into the chloritic schist observed below Boomot, and through that, on this side, into a perfect talcose schist, of white, yellow, and blue colours, &c. On the flat no rock is visible, but again in the bed of the stream, which comes down from Dhunpore, the granite rock, which I have called greenstone, is again detected, occasionally passing into a greenstone slate. It contains nests of indurated talc or potstone. The schists are always conformably stratified, that is, they dip to N. E., but the greenstone is generally amorphous. The schistose rocks continue, often verging on chloritic schist, and interstratified with quartz rock as far as the route lies in the bed of the Nullah, which is of great depth and narrowness, the sides of mural steepness laying open, in beautiful natural sections, all the particulars of the rock worthy of notice.

220. It was observed, that sometimes the change from the green schist to the quartz rock was sudden; sometimes a real transition is seen. In general, the schist has a stronger resemblance to the chloritic types, though it is also found a perfect hornblende schist. The dip and inclination of the strata present great local irregularities, the former being sometimes reversed within a few hundred yards, and the latter not unfrequently 90°. The direction appears to follow a curved line, being in the first instance observed as conformable, *i. e.* N. W. It is then seen to run N., from which point it gradually changes to N. 35° E. In the first case the dip was as usual N. E.; as the direction changes, the strata become wedge-shaped, and assume a vertical position, till at length it is found that the dip is reversed, being finally S. E.

221. From the bed of the Nullah, the route ascends to Dhunpore, where are worked the most valuable and productive copper mines in the mountains. The rocks which are found in the ascent to the Koangola Pass and descent thence are various in character, and a more enlarged examination of this neighbourhood is required to determine their true relations to each other. In the ascent to Dhunpore, quartz rock is the prevailing substance, which passes on the summit of the ridge into a very thin slaty rock of a yellowish colour, exceedingly hard, and composed apparently of quartz with some talc. The laminæ of this are not above a tenth of an inch in thickness. They separate with greatest clearness, are often bent or curved, are rather brittle, and consequently not obtainable of any size. This type might be called slaty quartz rock, in contra-distinction to schistose quartz rock. It passes into the pure amorphous type; argillaceous schist, then succeeds, variously intermixed with limestone more or less pure. The former occurs here of an intense black colour, similar to that of basanite. It has a schistose structure, but never separates into thin slates, the attempt to obtain such generally producing a conchoidal surface, or at least one more or less uneven. It is moderately hard, of a fine grain, receives a good polish, would form a most superior description of writing slate, and is not even inapplicable to the purposes to which basanite is applied. It has a cleavage, or set of natural joints, the surfaces of which present the appearance of a slight iridescence, or pavonine tarnish. This cleavage is most commonly, or at least very often, transverse to the direction of the schistose

structure. It is in contact on two sides, with an argillaceous or siliceous limestone, which in its immediate neighbourhood passes into a perfect rotten stone. What the nature or cause of this caries is, which so often appears to attack rocks of the greatest solidity, no one has yet explained in a satisfactory manner. The unchanged rock is of blue colour, impalpable in composition, with a conchoidal fracture, and in appearance resembling perfectly the most regular limestone. It is, however, a very impure one, being highly charged with argillaceous or siliceous ingredients, or perhaps with both, occasionally it even strikes fire with steel, and approaches the nature of schist. In its passage into the rotten stone it is observed, first to change a little in colour, becoming gradually more tinged with the peculiar mud colour of the latter, which is so far different from the rotten stone of Derbyshire, as to be of a more yellowish than a brownish tinge. The grain is observed gradually to make its appearance, and the rock to be full of joints or cleavages, till at last it is found of a dirty yellow colour, fine grain, very friable, and with a specific gravity of only 0.9. A series of specimens connecting the two extremes has been collected, which shews the progress of the change with great clearness; a rotten stone of bright colour appears to originate in a real argillaceous schist.

222. The rock in the neighbourhood of Dhunpore is, as I have already stated, a quartz rock, it is distinguished for its peculiar shattered and fissured aspect, no trace of stratification being observable except on the great scale. The irregularity of the strata is great, and the change of dip frequent. A mass of red dolomite appears in the middle of it east of the village, and it is in this latter rock that the copper mines are situated. This dolomite is evidently connected with the siliceous limestone on the Dhobree side, in which also a mine is worked, but the produce is inconsiderable. This mine is remarkable, however, for furnishing lumps of limestone, apparently changed by a similar process to that which produced the rotten stone, the result in this case being a perfect chalk; such a change in the surface of limestone fragments is common, and has been noticed in the preceding details; but excepting at Dhobree, I have never met such large pieces so perfectly changed to chalk. These fragments are used as a flux in the reduction of the copper ores.

223. On the Telkhunnee Pass, a brown schist is found, and thence descending to the village of Bissona, various modifications of the same passing occasionally into argillaceous quartz rock. Near the village, a granular rock is seen composed of quartz and indurated clay, having much the aspect of a greywacke. Here a mass of reddish limestone is found imbedded in the slate, in extent about 50 yards by 10, and capable of furnishing a very beautiful marble. Schistose rocks continue to Kirsal, where traces of limestone occur in local conglomerates, in tufaceous masses, and even as an ingredient in the more compound schists. The prevailing type approached to that of stone slate, being of a composition almost impalpable, moderately hard, and of colours varying from greenish grey through yellowish grey, to reddish and purpleish grey. These specimens are seldom of a perfect slaty structure, the cross fracture is easily obtained, and it is often conchoidal. Below Kirsal, these schists assume more of a chloritic or talcose character, and become more decidedly compound at the foot of the descent. Argillaceous schist is established of a very regular type, though it is found intermixed with the green schists also, which are of a chloritic character.

224. There is another route tending from the Boomot suspension bridge to this point in which the rocks have been examined, and it will be more in place to record the particulars here. This route ascends by the village of Acend, in which the talcose schist observed in the vicinity of the bridge is exchanged for quartz rock, containing, it would appear, nests of indurated talc. At the village, a decided chloritic schist is found. The dip in all the schistose rocks is conformable, but in the quartzose or granular types, the strata are obscure. Between Acend and Jak the same rocks continue with an occasional appearance of brown tender micaceous schist. From Jak to Bendoolee, the transition into the latter is more frequently observable, and it also assumes an argillaceous character. The granitic rock which I have for distinction sake termed greenstone also occurs, forming as usual a transition into the green schist.

225. From the village, the route descends to the bed of the Bendoolee Nullah, the rock being still chloritic schist, verging on argillaceous, and enclosing huge masses of quartz rock, the relations of which to the schist appear very interesting, and deserving of further developement. From what I could observe, it struck me, that these masses were

very large veins, their breadth being inconsiderable compared with their length, and their course oblique to the direction as well as to the planes of the strata; nothing like the marks of stratification can be seen in them, but they are traversed by seams in every direction, very similar in this respect to the smaller and less equivocal examples of quartz veins. One of these masses is observed to descend the mountain side into the bed of the stream and ascend the opposite side, always keeping the same direction, limited in breadth, and easily traceable by the eye for many miles.

226. In ascending the bed of the stream which descends from the villages of Ketee and Mulsee, and here joins the Bendoolee river, the chloritic schist is gradually exchanged for more decided argillaceous types. These are sometimes straight laminar, easily splitting into slates, sometimes sublaminar and schistose, in which case the cross fracture is easily obtainable. The former are more frequently of an iron black, the latter of a purplish, reddish, or greenish hue. The two routes here coincide; below Ketee a green schist occurs, remarkable for having two sets of divisions distinctly marked, forming an angle of 45° with each other, the one being parallel to the schistose structure; above Ketee again, quartz rock of a bright Orkney yellow occurs, fissured and seamed in all directions, so that a specimen of any size cannot be obtained. The slates too in great part when tried under the blowpipe, fuse into a slag obedient to the magnet. These indications point to an iron mine which is in the neighbourhood, but which I had not an opportunity of examining. The dip in this glen is always N. E., but the strata are nearly vertical, being frequently observed from 70° to 80°.

227. On the summit of the Pass Dewaluc Khall, quartz rock occurs, and descending thence to Murara, it is found to contain talc; fragments are observed here, which are a mixture of compact felspar and quartz, but the rock has not been observed in situ. Below Murara, micaceous schist is established, the dip being S. 35° W., and inclination 24°. It is full of small garnets; traces of felspar may be found in it, and I am not without an opinion, that gneiss is to be observed on the summit of the ridge just passed, although in the immediate route quartz rock alone may be visible. The micaceous schist continues to appear along the bed of the Ramgunga. Near Agura, a mass or bed of limestone,

of a siliceous or magnesian character occurs; it contains crystals of dolomite, (brachytypous lime haloide,) and traces of green carbonate of copper (hemi-prismatic habroneme malachite,) also of copper pyrites (pyramidal copper pyrites.) A mine was formerly attempted to be worked here, but either from want of skill or perseverance, was abandoned without any profitable result.

228. A rock occurs here, but in no large masses, which may with perfect propriety be termed a gneiss. It is of a curved or undulated schistose structure, and the composition is heterogeneous or mixed. The ingredients are so disguised, that it is difficult to speak with perfect precision, but it appears to me to contain quartz, felspar, mica and indurated clay. The second ingredient is the most doubtful, and exists in least quantity. Close by this rock is found one of a brownish yellow colour, structure amorphous, composition simple or uniform, and earthy like chalk, tender and friable, traversed by veins of a darker colour, but the same in every other respect. This rock also occupies but a limited space, and is succeeded by a micaceous schist of a blackish blue colour, apparently much charged with argillaceous matter. I should note, that the summits of the surrounding ridges are limestone, recognised with great certainty by their peculiar outline, and mural precipices stained with yellow and black.

229. The preceding particulars apply to the immediate neighbourhood of Mehul Chowra, the halting place below the Pass of Prendooa Khal. In the ascent to the latter, quartz rock and siliceous limestone are found; still higher up, a purple argillaceous schist, containing mica, which graduates into a yellowish white micaceous schist; fragments were found of iron stone and of indurated talc. On the Pass, limestone often highly siliceous or argillaceous prevails, and it is accompanied, as it always is, by its local conglomerates, and its tufaceous deposits or incrustations. On descending from the Pass, a great deal of the same rock is observed, but down in the river valley, it is seen to rest on argillaceous schist, the limestone still continuing to run along the summits, and occasionally descending lower down. It is in the junction of these two rocks that the beds or veins of iron ore occur, which are annually worked, during the healthy season, by emigrants from other parts of the country, who all quit the valley in May, when it is said to become unhealthy.

230. These mines are said to produce metal of a better quality than any others within the mountains, and this circumstance I attribute to the ore having generally a proportion of calcareous matter, which it is well known is one of the best fluxes, the ore itself being of the most common kind, red iron ore, (rhombohedral iron ore of Mohs.) The clay slate in which most of the galleries are situated, is of a peculiar character. It is generally of a reddish or purplish hue, fine grain, not compact, splits into wedge-shaped schist, and with remarkable facility. There is also a cross cleavage which prevents the acquisition of large pieces; the spotted delineations which are sometimes observable in it, when viewed hastily, resemble imbedded nodules. They are always of a lighter colour than the general ground, being usually white or peagreen. The shape is elliptical; when they become very numerous the slate passes into an amorphous rock, which has all the aspect of a conglomerate.

231. From Katsaree to Mehul Chaura, the route turns up a lateral glen, the bed of a feeder of the Ramgunga. The debris is however thick on the mountain sides as well as in the valley, and the rock can only be guessed at; limestone is seen occasionally at the summit of the ridges. Between Mehul Chaura and Dooara, however, the rock appears in the bed of the stream. The first occurrence is that of the purple scaly schist, which seems of a nature intermediate between micaceous and argillaceous schist. It dips to the East of South. This is succeeded by an earthy and subschistose gneiss, which dips S. W. 10°, micaceous schist is then found, and resting on it a granitic gneiss which is connected with the series of granite beds so often alluded to, and which will be described presently. The fragments in this valley consist of clay slate, quartz rock; and latterly mica slate, gneiss and hornblende rock, as also chloritic schist.

232. We may now return to Punnae, Art. 67, from which place is another route that has been examined, leading down the valley of the Aluknunda. The granitic rock which I have called greenstone, was noticed, as occurring in the bed of the Dhunpore Nullah; beyond that point the talcose-granular scaly rock is seen to occupy great extent, similar to that which has been described, Art. 221

It is remarkable here for containing much larger concretions than usual; some of them have a perfect resemblance to rounded nodules imbedded, and indeed they can be detached from the including base. The rock is therefore certainly of the nature of a conglomerate, and this fact is further proved by the occurrence of rounded nodules of clay slate in an adjoining quartz rock. The concretions of the talcose granular scaly rock are always quartz, but of a peculiar resinous lustre, very unlike ordinary quartz, and in colour always inclining to blue or purple. This rock is a good instance of the deficiency we labor under, from our scanty nomenclature of rocks. It is very well characterised, and has consequently been recognised by me in many and very distant localities, yet we have no name by which to designate it, unless we call it quartz rock. It is singular, that in two of the localities where it has been traced, pieces of clay slate are found imbedded in the adjoining rocks, a phenomenon I have no where else observed. It here passes into the more ordinary quartz, which is occasionally chloritic.

233. The rock at Nugrasoo is the same quartz rock, and it possesses the usual fissured aspect so often noted as characteristic, it being very difficult to detect any thing like the appearance of strata even on the great scale. In proceeding to Tirnee, at one of the lowest points in the route chloritic schist is found dipping to the E. at an angle of 56°. Whether a solitary included bed or connected beneath with the extensive strata observed near Punnae, Acend, Jak, and Bendoolee, (Art. 224) is difficult to say, for want of that full access to the junctions of rocks which so often interferes with observations in the mountains. From the little I have myself observed, I am of opinion, that chloritic schist is more generally a member of series than a single formation in itself, at least when we speak of the more decided types, they being seldom found of any extent compared with micaceous or argillaceous schist. The quartz rock passes into the talcose granular scaly rock, thus proving its geological identity; but this would no more absolve us from giving it a name, than it would the several other rocks that graduate into each, but which yet have their distinctive appellations. An imbedded nodule was observed here, (being the largest seen,) weighing at least two and a half pounds, and it was readily detachable after fracture. The existence of conglomerate rocks amongst primary strata has been contended for by many geologists. De Saussure and Mr. Weaver are amongst the best authorities I can just now recollect. Assuredly the aspect of these rocks is at once sufficient to separate them from the

secondary conglomerates, nor could the merest tyro on being shewn both, hesitate to discriminate between them. The most obvious distinction is the less earthy or mechanical appearance of the basis and the greater rarity of the imbedded pieces. Is the conglomerate structure, such at least as it is found in crystalline rocks, one which can in any instance be explained by chemical composition, as affected by the many disturbing causes which may well have been supposed to influence the results ? In particular, can we derive any explanation of such a phenomenon from the galvanic energy which we may suppose would be developed by the interstratification of so many heterogeneous, and consequently in some degree anti-polar substances ? Assuredly this cause has had more effect than is generally attributed to it in many of our geological phenomena. Whether the present be one which falls within its domain, remains to be determined.

234. Limestone begins to shew itself in detached masses and fragments; and before reaching Tirnee it occupies considerable extent, and is seen crossing the river valley in well marked strata, which dip N. E. It is generally very impure, being mostly argillaceous. At Tirnee, I found blue argillaceous schist; on ascending a ridge the limestone again appears, always argillaceous; descending thence, argillaceous schist is once more established, and continues to Poondaroo village, opposite Roodur Prag, the confluence of the Kalsee with the Aluknunda. It presents some curious appearances, which require a little detail. It is at first of a perfectly white color, soft and earthy, similar in fact to chalk, in all save its schistose structure, and in this respect it perfectly resembles the hard blue slate into which it gradually passes. Below the point where this change has taken place, a mass of the greenstone I have so often had occasion to notice may be seen. There is not any transition to be seen between this rock and the blue slate, but it passes into a green slate, whether chloritic schist or greenstone slate, is difficult to determine. The specific gravity is rather in favor of the latter. That of the greenstone is 3.0, it contains therefore evidently either hornblende or augite (hemi-prismatic augite spar.) Besides this, a light yellowish green mineral may be observed, very much resembling serpentine.

235. In its lower limits it appears to pass into a green quartz rock, coloured no doubt by the same mineral to which it owes its character.

This quartz rock is permanent for a long distance, but assumes various changes of colour. It occasionally appears to pass into a tender green slate, occasionally to oscillate towards the greenstone, and even to hornblende rock. It is sometimes so hard, as to defy the hammer completely. One type appeared to contain felspar, another, a schistose fissured grey rock, containing a few amygdaloidal cavities. It passes into a greenish grey rock, with rombohedral cleavage, and fine granular composition. These several changes extend as far as Hurkonda glen, in the neighbourhood of which argillaceous schist is again met with, and occasional masses of calcareous tufa and local conglomerate, shewing the proximity of limestone. The schist continues nearly to Soocet, near which a mass of quartz rock occurs. It is seen to descend to the river bed and across it, rising on the other side in strata nearly vertical, the direction E. and W. and the dip if any thing South. The slate again appears, and in the immediate neighbourhood of Soocet, where the valley narrows, it is exchanged for limestone of a very cherty type. It contains crystals of dolomite, (macrotypous lime haloide.) At Soot, the schist is once more established, but appears to have changed its character.

236. It may be seen in the bed of the small Nullah which runs below Soocet, of a perfect talcose aspect, the colors bluish grey, the structure straight laminar, the lustre metallic pearly, and so soft, as to be scratched by the nail. It dips S. 5° E., at an angle of 48°. It is succeeded, in proceeding towards Sreenuggur, by a greenish grey talco-argillaceous schist, approaching to the character of chloritic schist. The laminæ are sometimes very much contorted, being in one particular instance bent up into a saddle-shape, even within the compass of a specimen. This rock is always recognisable by the minute wave-like undulations with which the laminæ are marked, and which are peculiar to it. The dip is South along the whole line to Sreenuggur, but the rock so seldom visible that much stress cannot be laid on this determination.

237. Enormous beds of diluvium, or rounded stones and gravel, may be observed here, forming the floor of a valley remarkable in this rugged country for its extent and beauty, though it be but five or six miles long, and no where a mile wide. These accumulations rest on different sides of the river in different parts of this line, so that small as it is, it is not even continuous. Their height above the river bed is ge-

nerally 60 to 100 feet; but with regard to this point it may be observed, that in the widest vallies these beds have least height, and vice versa. Their face generally forms a precipice, in which all the several sizes of stones may be seen sticking in a loose basis of gravel and sand. Sometimes two or three terraces are formed, the last being of inconsiderable height above the bed of the river. In the latter, may be observed the same kind of stones that compose the terraces, leading to the inference that the present opening was once filled up, and that the river must have flowed so much higher than its present level. It is a very remarkable circumstance too in these beds, and shews that there is some connection between their accumulation and the system of rivers, that they increase in extent as the river advances towards the plains; very limited deposits occurring in the upper part of the course.

238. The magnesian clay slate is found at the suspension bridge over the Aluknunda, south of Sreenuggur, while close to the town, in the bed of the river, a rock approaching to the character of micaceous schist prevails. Perhaps it may more properly be called micaceous quartz rock: it also dips to the southward. On ascending from Sreenuggur are seen the accumulations of rounded stones above the present bed of the river, as determined by Barometrical observation. The rock is the magnesian clay slate, which continues the whole way to Pooree, a village on the high range which shuts in the Chipul river. It oscillates both towards micaceous schist and towards talcose, its affinity to the latter being greatest, but no genuine argillaceous schist is produced in any of its changing types. The dip is in general conformable, *i. e.* between N. and E., excepting immediately on the ascent from Sreenuggur, where it was observed to be S. 10° E., the inclination being 60°.

239. From Pooree to Olee, the road passses along the range abovementioned, crossing over it near the latter village which is situated a little below in the bifurcations of a glen. Half way the slate is exchanged for quartz rock which appears stratified, dipping 65° N. E., at an angle of 50°. Here also this rock possesses the veinous character, appearing to traverse the other strata in masses much more remarkable for their length than their breadth. It is seen to cross the valley here, and continue its course on the opposite side; occasionally it appears to contain felspar. It passes into a green type, which gradually changes

to the greenstone so often noticed; but which occupies a very limited space. The quartz rock again becomes established, and continues from Olee to Bidholee, and thence to Milcee, which is situated in the valley of the Nyar river. Near the latter village, a subschistose argillaceous rock occurs, and in the ascent up the valley of the Pilgad, which joins the Nyar below Milcee, the tendency to an argillaceous character increases. In this part of the route, two types seem to divide between them the rocks observed; one may be characterised as argillaceous quartz rock, the other as quartzy argillaceous schist. The first cleaves into rhombohedral fragments, has a conchoidal fracture, the composition impalpable; the second has a schistose structure and small granular composition. They run naturally into each other, and may be considered, geologically speaking, as the same rock. The first is seldom stratified, always seamed; the second is generally stratified, although the strata are irregular and appear under that relation termed wedge-shaped. One observation gave the dip N. 45° E. with an inclination of 36°. Not far from this the dip was observed N. 80° to 90° E., inclination 40°. The quartzose type prevails to some distance above Bidholee, and is gradually changes in the ascent from the bed of the stream to an argillaceous schist of more decided character. The latter passes into chloritic schist, which conducts us to strata of gneiss connected with the series of granite beds, to which we shall presently come.

240. In the meantime, it will be necessary once more to look back and take up the thread of our description broken off in Art. 159, and to trace the argillaceous strata in another direction at the village of Girgaon where the last traces of gneiss were lost, although in the river-bed beneath occur numerous blocks of that rock. The character of the formation which succeeds is argillaceous, including, however, extensive beds of limestone; sometimes there is a kind of transition observable between them. This continues without much variation as far as the hot spring below Rumaree on the Ramgunga, into which the Jankoola river (below Girgaon,) falls. At the bridge over the Ramgunga the rock is clay slate, and dips N. 15° W., at an angle of 35°. The ridges appear to consist of limestone stratified distinctly, and dipping also N. W. Above Rumaree, argillaceous schist occurs of a lead blue colour, containing quartz; fragments of a conglomerate are then met with, and latterly in the ascent to the Pass above Sama, a brownish granular

schist, which might be called a greywacke. On the summit of the Pass, there is no rock in situ, and fragments of micaceous schist are to be seen. Thence to the village of Sama, we are accompanied by ordinary blue limestone distinctly stratified, and of a sublaminar or slaty structure, which is not, however, developed without weathering.

241. From Sama to Buret, the same rock prevails, frequently remarkable for the white vein by which it is traversed. Sometimes the two colours, form alternate layers, the rock having thus a striped appearance. It is occasionally very argillaceous, and passes into a shattery thin laminar rock, very like that described in Art. 226, the only difference being a black or blue colour, instead of red, green, or purple. In this state, it no longer effervesces with acids. In the bed of the stream leading down from Sama, the fragments are either blue limestone or crystalline dolomite, or of clay slate a very few; but at the bifurcation below Mawgaon, immense blocks of gneiss, similar to those observed below Girgaon, are to be seen. Their source is evidently in the glen, which here joins the Suma glen, and they shew the proximity of the boundary of the gneiss district.

242. From Buret to Kubkot on the Surjoo, limestone still accompanies, as passing down the Ramgunga to its confluence with the Surjoo, and then down the latter river. It appears to be stratified distinctly on the large scale, the strata being always best marked where the rock is most impure. They appear sometimes to be vertical, and the direction, as far as it could be ascertained, is S. 20° E. Sometimes it contains talc in notable quantity, and then the rock is highly fissile. The rounded fragments in the bed of the river are numerous, and many of these are white crystalline dolomite, (macrotypous lime haloide.) Near Kubkot, the dip was observed to be Southerly, so that there must be evidently some great irregularity here. The sameness of the limestone features continues to Gryket, also in the bed of the river, the surrounding ridges bearing testimony by their appearance to their identity with the lower strata, occasional patches of argillaceous schist then diversify it, although it is still the prevailing rock. The fragments in the river bed consist of limestone and quartz rock. A small patch of black argillaceous schist is found a few miles above Bagesur, the place being further remarkable for the deep bed the river has worn in the limestone, hollowing it out into caverns and deep holes, in some of

which it has a depth of perhaps 30 feet or more; although at Bagesur, some miles below this point, it is fordable, being scarcely three feet in depth. The tendency of this rock to be worn into caverns and hollows is a very curious feature, nor am I aware that any satisfactory explanation has been given of it. The dip at this place was observed to be S. 30° W., and the inclination 52°.

243. Hence to Bagesur, one of those extensive flats so often formed in the river beds prevails, nor is any rock in situ discoverable; at that place the strata are quartz rock, and they dip N. E. The river bed is full of rounded limestone fragments, but below the confluence of the Goamuttee, which originates in the valley described in Art. 65, the fragments are as often gneiss and quartz rock. Another extensive flat reaches from this point for nearly two miles, and debars access to the rock. At its termination, calcareous tufa and conglomerate are seen, but not apparently of great extent. A third flat then occurs, and after passing it, argillaceous schist is established, and it continues in the ascent to the Cheer Nullah, a small stream which comes down from the range separating the vallies of the Surjoo and Cosillah. We have then a limestone of a yellow color and fine granular, containing a large proportion of talc, and a little higher up, nests of indurated talc are found of a light buff colour. Thence, argillaceous schist and limestone are irregularly mixed, the latter forming the summit of the range. It is of a magnesian character when pure, being in fact a compact dolomite; but is generally so much charged with siliceous matter, as to become a kind of chert. In its pure magnesian state too, it has no inconsiderable resemblance to the latter rock. The colour is a bluish grey, which occasionally changes to flesh colour. It contains veins of galena, (hexahedral lead glance.) The strata when observable, appear to dip N. 60° E., at an angle of 60°.

244. In descending from this range, argillaceous schist is again met with of a very soft type, and of various bright colours, similar in fact, to the rock observed in the Cosillah, (Art. 152.) The strata are so irregular in dip that no mean result can be attained. It sometimes contains quartz. In ascending to the Kurnyud Pass, micaceous schist occurs, and occasionally with felspar; fragments of gneiss are abundant. Descending from this Pass into the Suttralie glen, we find an earthy gneiss, very similar to that described in Art. 134, which prevails in the

Goamuttee valley. This rock dips S. 33° E., at an angle of 38°. Here also may be seen a brown amorphous rock, of a very anomalous character, the true relations of which further enquiry is wanting to develope. A little further, micaceous schist, covered with an aluminous efflorescence, dips S. S. E. This latter rock continues to the foot of the ascent, occasionally taking in a little felspar. In the ascent to the Pass above Bhynsoolee, gneiss is again found in strata nearly vertical, containing beds of hornblende schist, and having here again come upon the tract connected with the series of granite beds, we shall once more leave off, and pursue two other short lines of route, which yet remain to be described previously to entering on those details.

245. The first of these leads from the bridge over the Kalee at Joolghat to Lohooghat, the cantonment of the 2d Nusseree Battalion of Ghoorkhas. At the bridge, strata of a very pure limestone occupy the bed of the river, and form unexceptionable natural piers for this structure. The dip was N. E. In ascending, detached masses of compact limestone and conglomerate, (enclosing pieces of quartz rock and clay slate,) are seen; a good deal of stalagmitic and stalactitic incrustations are noticed, shewing that masses of limestone are doubtless prevalent, though from the nature of the surface not always visible. At Booralee, or a few miles before coming to that village, a purple argillaceous schist makes its appearance; some of the types are granular, and might be called a greywacke schist. It also passes into a compact slate of a light yellow or greenish colour, very similar to hone slate; as such it has been used, and found to answer. These rocks occupy the road as far as Petorahgurh, and the dip is generally N. or a little W.

246. At Petorahgurh, patches of limestone are found in it of a pure type and blue colour. This rock, as has been often observed in limestones, has a sublaminar structure, weathering so as to have often the appearance, in detached pieces, of a series of layers or thick leaves joined together. It sometimes divides into thin slabs, which are, however, very unlike the slates of an argillaceous character, as they admit of a cross fracture with great facility, which is as usual conchoidal, and not hackly like that of the latter rock. The schist here is very variable in aspect, yet never loses its argillaceous character. At the cantonment, it is quite soft, and might pass for a yellowish clay were it not disposed in slates, which however will not bear handling, as they fall to pieces

immediately being minutely intersected by cleavages, the effect of which is to resolve them into rhombohedral fragments on the slightest impulse being communicated. The small hill on which fort Loudon is built consists of this rock, and on its summit, lay some very large boulders of a very tough and hard greenstone, the removal of which occasioned the Officers employed in clearing the ground, not a little trouble.

247. This rock I call greenstone, for it has not the smallest resemblance to hornblende rock in appearance. I have already mentioned its frequent occurrence in tracts of argillaceous schist, and I shall endeavour here to collect all the particulars I have observed with regard to it. It is a composite rock, consisting of two distinct substances, the one a dark olive green, the other a lighter colour, more perhaps of a greenish grey. The structure is small grained granitic; that is to say the minerals are obviously distinct, while yet they are in perfect contact throughout. The fracture is subconchoidal, taking its character in the small from the size of grain which it discloses. It is very hard, and in toughness I know not its equal. The specific gravity is upwards of 3.0, sometimes as high as 3.2. It is very fusible under the blow-pipe, and will bear drawing out into threads similarly to glass. If there be really a distinct species of felspar which has been hitherto described as the compact, I should be inclined to view the lighter coloured ingredient as an example of it. The dark one is either hornblende or augite, but the grain is too small to allow of a satisfactory determination.

248. This rock is not seen here in situ; these blocks being the only traces of it, but in other places, as already detailed, regular gradations occur, uniting it with the most ordinary schistose rocks, very frequently the transition is made through quartz rock; altogether it is a very interesting member of our mountain strata, and the full developement of all its relations is a task the execution of which I expect will throw considerable light on some interesting questions in geology.

249. From Petorahgurh in the descent to Surjoo, argillaceous schist is the prevalent rock, indeed the only one, with the exception of a few beds of limestone. It is mostly of the type just described, (Art. 246), but some others are also met with. In particular one, having a suite of colours between olive and bright red, in hardness about equal to gypsum,

splitting generally into slates of moderate thickness, but which are often curved, smooth to the feeling, and having a slight degree of lustre. I think this type owes its peculiar character to the magnesia it contains. It is found between Petorah and Goon; near the latter place, it is succeeded by a yellow rotten stone, which has apparently originated in an argillaceous rock of a less schistose character, or perhaps even in calcareo-argillaceous strata. It is remarkable for its rhombohedral cleavages, breaking into fragments of that shape on the application of the hammer. It is of arenaceous composition, and its specific gravity is very low, about 1.5. In its vicinity are found small masses of a soft argillaceous limestone, of a light olive colour, which might perhaps be of use in lithography. They form the only type of limestone I have met with in these mountains which hold out any prospect of being available for the purposes of that art. In general, the lithographic stones used in Europe are derived from the secondary strata, and even in these, the properties essential to the most perfect specimens seem to be peculiar to a very small tract in Germany, neither France nor England having yet furnished stones to compete with those of the former country.

250. The soft magnesian clay slate of different colours, which is found near Goon, also prevails at Doodar. On the ascent to the Thakil Peak, which lies a little to the left of the route from Petorah to Lohooghat below that village, a bluish grey schist, of a shining lustre is found, traversed by white veins. In ascending from Doodar to the Peak, the rotten stone noticed near Goon, and of a bright ochrey, colour occurs, but undistinguished by the peculiar structure of that rock, the present one giving an amorphous irregular fracture. Above this, lies a fine greywacke schist of a dark blackish grey colour, which passes into a rock that strikes fire with steel. The summit of the peak is a silicious limestone that occasionally passes into schist. It projects in amorphous weather-worn nodules, and is full of veins of flint (var. rhombohedral quartz.) This is not a common mineral, at least in the form of veins, to be found in limestone. It is of two kinds: the one a dark brown, exactly similar to the ordinary gun flints, the other a white opaque substance, occasionally becoming translucent, and not very unlike the mineral called cacholong. These veins are more persistent than the bulk of the rock, which indeed appears

to be singularly subject to atmospheric wear; the consequence of this difference of durability is the projection of these veins on the surface of the rock, giving it a singularly rugged appearance. It is probable also, that particular parts of the rock not veinous in appearance, partake of this durability, and thus occasion that nodular aspect so characteristic of this limestone.

251. Is there any connection between a primary limestone with veins of flint, and the chalk strata enclosing rolled pebbles of the same mineral? The occurrence of flint pebbles in chalk has always appeared amongst the wonders of geology to the uninitiated. The difference of composition between chalk and primary limestone is perhaps as great a one, and not a little difficult to account for. The primary limestones we see, however, are subject to a caries, which as far as it goes, produces a perfect chalk. In that state it is obvious that the action of any of the numerous causes of the disintegration of rocks will be more powerful. If we then suppose that the flint being set loose, splits into numerous fragments of all sizes, and will, by the same cause that transports the loose chalky matter, be worn down on its edges and at last rounded, we shall perhaps have an explanation not at all improbable. If this be not an exact account of the phenomena, it at least, by shewing how natural and simple the process which might have produced the actual state of things, serves to take off some of the edge of our wonder.

252. In descending to the Surjoo from Goon, we find argillaceous schist occasionally of the same character as that observed in the ascent to the Thakil Peak, (greywacke schist.) It is, like that, of a dark grey colour approaching to black, and is remarkable for splitting into prismatic fragments on being struck. A good deal of calcareous stalagmite occurs, and a soft white or light grey schist, intermediate between clay slate and talc slate. Latterly, limestone is abundant, and in the bed of the river we have gneiss and quartz rock, with fragments of hornblende rock in addition to those of limestone and the two preceding. The gneiss continues from the bridge upwards, at first of a fine grain afterwards coarser, and containing superadded amygdaloidal concretions of felspar, similar in fact to the type described, Art. 80. Beds of mica slate and of quartz rock are contained in it; the latter furnished the only observation of the dip which was S. 30° E. and inclination 60°. At Burakot, argillaceous strata again prevail, and furnish some very anomalous rocks

in their several changes of type. A dark grey almost amorphous rock, with fine granular composition, conchoidal fracture, very hard, but rather brittle, which occurs near Burakot, is one of the most remarkable. Were it not for the decided absence of the arenaceous structure, I should be inclined to term it a greywacke. It contains, I think, carbonate of lime as one of the ingredients. It passes into a perfect roofing slate, which is found in great abundance just below the cantonment. Here we come upon the line of route which belongs to the description of the granite formation, and we must therefore return to Petorahgurh, to finish the details of the route thence to Almorah.

253. In the ascent to the ridge just above Petorah, the new road gives excellent views of the strata, and it were much to be wished, we could elsewhere gain the same access to the rocks as we do here. The soft and clayey rock of the cantonment appears to pass into a dark black rock of sublaminar structure. It breaks with an uneven, irregular, rather than a conchoidal fracture. It is often stained in the interior of a light ash grey colour, very similar in appearance to a piece of half-burned charcoal. At the summit of the Pass dolomite of a large crystalline grain occurs. It contains veins of indurated talc, (var. prismatic talc mica,) and also of very fine, large rhombohedral crystals of dolomite, (macrotypous lime haloide.) The indurated talc is of various colours, but most commonly jet black, a variety not noticed by any of our mineralogical writers. It assumes a very good polish, and would form a very beautiful material for small ornaments for a table or chimney piece. It is not however in any quantity.

254. The dolomite is evidently a bed in the slate, for almost immediately on descending the Pass, the latter rock again occurs. It is here of a white colour, and of micaceous composition, but still slaty in structure. It is again exchanged for the black rock with light grey stains. The debris here consists of a very fine ochrey clay of a good colour, and which might be useful in the arts if prepared properly; besides the bed of dolomite, beds of talc slate are found, and in this rock is situated the copper mine, which is, however, worked on a very small scale, producing only 50 Rupees per annum. The argillaceous schist continues down this valley, (Shor Goorung,) irregularly intermixed with dolomite, which is very often compact, containing veins of the crystallised mineral, and very often appears to pass into the slate. It can seldom be seen in

well-defined strata, rather appearing like amorphous projecting masses, unless when impure, and then the strata are as well marked as those of the better defined schists. In two instances, the dip was observed N. E., inclination 20°, and N. N. E., inclination 32°. The first of these was a purple arenaceous rock, containing a good deal of carbonate of lime, the second was an almost pure compact dolomite of a light grey, and remarkable for its conchoidal fracture, toughness, and hardness.

255. In the descent to the bed of the Ramgunga, chloritic schist of a perfectly pure type occurs, being in fact green talc slate; it contains metallic copper disseminated, but no attempt has been made to work it. In the bed of the river a schist occurs, which may well be called talcose schist, being a mixture of quartz and talc. It bears the same relation to talc, (prismatic talc mica,) as rhombohedral talc mica. It is in this particular place schistose, and distinctly stratified; but in other quarters, it passes into a massive rock, bearing the same relation to it, which ordinary quartz rock bears to the above schist. It is in fact a talcose quartz rock, as we may call the ordinary type micaceous quartz rock. The titles talcose and micaceous schist might be confined to the schistose types of this compound rock, and that of talcose slate, to the slate composed entirely of indurated talc. This would introduce some precision into our account of rocks. In like manner, chloritic slate should be reserved for the pure mineral, and chloritic schist for the compound types. Without a reform, terminology will never make any real progress.

256. From the bed of the Ramgunga, the route ascends to Gungolee Hath, on the valley of that river from that of the Surjoo. The talcose schist passes into a quartz rock in which the talc is gradually lost, until it at length very closely resembles a sandstone in appearance, argillaceous schist then establishes itself, but whether by transition or per saltum, the state of the surface does not admit of deciding. The dip was observed to be N. 7° E., inclination 45°. Towards the summit of the ridge, magnesian and siliceous limestones begin to prevail, and the crest is entirely composed of a flesh-coloured dolomite, with purple clouded delineations, which I think would form a very handsome material for various ornamental works, as it takes a very high polish, and is not more difficult to cut than ordinary marble. It is traversed by veins of a purplish brown calcareous spar with curved

cleavage, and so strong a pearly lustre, as to be at first mistaken for dolomite spar, (macrotypous lime haloide,) but its specific gravity and ready effervescence with acids, shew it to be rhombohedral lime haloide: veins of a resinous quartz; bluish, black and white, are also observable.

257. In descending to the Surjoo, a little blue limestone is seen, and one patch very beautifully variegated with yellow veins of carbonate of lime. The prevailing rock, however, is argillaceous schist; a good deal of what might, in following up the distinction, (Art. 246), be called clay slate also prevails, soft and distinguished by its series of colours as well as by its patches of a different colour from that of the ground. At the bridge, the rock dips S. W. In ascending from the river, an impure hornblende rock begins to appear, remarkable for its numerous cleavage places, which render it so difficult to distinguish the lines of the strata. Hornblende and actynolite schist are found, and a white massy rock, which from a cursory examination, I supposed to be a compound of tremolite and quartz, as the three substances, hornblende, actynolite and tremolite really constitute but one species, (hemi-prismatic augite spar,) there is nothing improbable in this opinion. I have to regret in this, as in many other instances, the want of access to the specimens collected, in drawing up this paper, which prevents me from revising particulars of this description, stated hypothetically in my note book.

258. The hornblende schist ceases a little above the village of Neoolagoon, and is succeeded by gneiss, which is of a porphyritic type, containing superadded prismatic nodules of felspar. This mineral in every case appears to be of greater durability than the basis or ground, and the nodules consequently remain projecting after the other has in a measure disintegrated, giving the rock an exceedingly uneven and rugged surface. The dip was observed to be S. W. Near Jagesur, this gneiss is succeeded by micaceous schist, dipping to S. S. W., with an inclination of 60° above Jagesur. On the Pass the dip had changed S. W. This rock continues to Almorah, and presents nothing very worthy of remark along this line. Near Chandeswur, it dips to S. S. E., with an inclination of about 15°. A few miles from this, it contains beds of brown iron ore, (prismatic iron ore,) which are said to furnish a very good metal. The ore contains a little manganese, rolled pieces composed of grains of quartz sand, and octohedral crystals of magnetic iron ore (octohedral iron ore,) are

found scattered about the surface of a hill in the vicinity of this mine, but no trace could be obtained of a deposit in situ. These pieces are all natural magnets, and have two or more poles according to their shape. Under Kaleenath, the schist becomes highly carburetted and soils strongly; some pieces are white, and on the summit of the ridge where the carburetted type entirely prevails, nodules of graphite are found. The dip in this vicinity changes to N. 44° and N. 22° W., the inclination being 45° and 30°. The rock is latterly extremely like a sandstone, and so friable, that no specimen is obtainable.

259. A short line yet remains to complete the details of the schistose band of rocks, previously to entering on the description of the granite beds. It is the route followed in an excursion from Petorahgurh to visit the copper mines. At Seera, argillaceous schist prevails for the first few miles, to which succeed dolomitic rocks of very variable appearance and grain. Occasionally, they are of very loose aggregation, and crumble to pieces in attempting to procure a specimen, occasionally though these latter are chiefly fragments. In the bed of the river they are so hard and tough that the hammer will scarcely make any impression on them. In every case the grain is crystalline, but very various in size, even within the limits of a hand specimen. Clay slate occurs of a deep iron black colour with straight laminæ, very hard and very brittle. It has a kind of iridescent tarnish, sometimes, on the face of cleavage. Near Kinder Besool, the limestone rocks, less decidedly dolomitic, continue mixed irregularly amongst patches of slate.

260. The route now ascends to Dhurmgurh, situated on the ridge which overlooks the Seera valley, carrying clay slate along that line, and then descends to the mines, which are immediately below the Pass. They are situated in a formation, or bed I should rather call it, for the former term is too general, in which indurated talc, (potstone and talc slate of geologists,) and crystalline granular dolomite are irregularly mixed. They must indeed here be considered as the same rock, geologically speaking, for they mutually interfere, and hand specimens may be obtained in which both substances are separately observable as well as in mixture; access is wanting to the junction of this bed with the surrounding slate, so that its exact nature cannot be ascertained, that is to say, whether it be really a bed or vein. The copper ore is most commonly copper pyrites, (pyramidal copper pyrites,) and it is

associated with iron pyrites, (hexahedral iron pyrites.) These minerals, particularly the latter, are often found imbedded in the potstone. Some part of the galleries are cut in the dolomite rock, part in the potstone, as the two rocks are continually interchanging, so that a gallery begun in the former will, after 20 or 30 yards, be found to be in the latter. The copper evidently traverses both rocks, and as far as the miners' accounts can be trusted, is in veins.

261. Till the publication of Professor Moh's system, great confusion existed on the subject of these two mineral species. We have in some of our most approved system-mongers, long and laboured articles, consisting of many pages of description, tending to shew, that massive talc was something different from potstone, and these again from soapstone; yet if we examine their several qualities, we shall find them identical. Professor Mohs, with the judgment which he has shewn throughout his work, at once rejected futile distinctions that were without differences, and has not hesitated to connect, as mere varieties, scaly talc and potstone. The truth of his views, if they required confirmation, would be found every where in these mountains, where an uninterrupted series of gradations may be traced, from the most perfectly amorphous potstone, through talc slate to the scaly mineral, usually considered a distinct species. Previously to the publication of that excellent work I had found so much difficulty in reconciling the contradictory accounts of mineralogists, that I determined to form a collection of the various types of this mineral, and in consequence, had satisfied myself, that there is in reality no difference whatever in essential character amongst the varieties, which hitherto have figured as distinct species. The inaccurate determination of specific gravities by early writers, servilely copied by their successors, has been partly the cause of this and many other of the opprobia of mineralogy. The following determination of this element, obtained from the specimens above alluded to, will serve to shew, how absolutely the same it is in the different varieties, and to confirm the accuracy of the limits fixed by Professor Mohs, viz. 2.7, 2.8.

White potstone, (Seera Mine,)	2,712
Black ditto, (Shergarury,)	2.76
Greyish ditto, (Seera,)	2.76
Yellowish soapstone, (Kuree,)	2.79
Do. very steatic, (ditto,)	2.74

Indurated talc, (Government Collection,)	2.77
Ditto, a second specimen,	2.7765

All these had precisely the same degree of hardness.

262. The dolomite has been equally well discriminated, and correctly fixed by the Professor. The accounts of previous writers only serve to confound the student with tenfold perplexity, from which he is only extricated by his clear views, and precise determinations. That they will very much tend to raise the character of a science, which till his book appeared was but empiricism, is obvious. Of their utility to the student I can myself bear witness, and this very mineral, as well as calcareous spar affords many instances. The limits of the latter are fixed at 2.5 and 2.8, of the former at 2.8 and 2.95. The following are some determinations I made :—

Grey compact dolomite,	2.826	Pass, road to Bagsar above Belowree.
Greyish white dolomite spar,	2.850	Goorung.
Yellowish grey ditto,	2.99	Bed of Mahepore.
Dolomite spar large rombohedrals,	2.83	Shor Gorung.
Compact dolomite, purple,	2.83	Gungolee Hat,h.

Of these the third only exceeds the limits, and this by so small a quantity, that it is very likely a revision would bring it equally with the others under those limits. The veins of purplish brown calcareous spar, which are found in the Gungolee dolomite, have the external characters of dolomite spar quite perfect; that is to say, pearly lustre, opacity, and curved or ill-defined cleavage. Being also contained within a magnesian rock, I naturally placed it amongst the specimens of dolomite, but in determining its specific gravity as one of the above list, I found it to be only 2.67. A re-examination and the test of acids satisfied me, that it was really calcareous spar. This is one amongst a hundred instances in which external characters alone are found perfectly inefficient to discriminate minerals, nor is there any thing in the history of science more truly surprising than the pertinacity with which mineralogists have hitherto resisted putting their system on the secure basis of numerical determination.

263. Below the mine, very beautiful massive talc of a snowy whiteness occurs, mixed with unequally white crystalline dolomite. The former is, however, intermixed by rents or fissures, preventing the acquisi-

tion of a small piece even applicable to the purposes of the arts. It passes into a yellowish grey talc slate, in straight laminæ a very beautiful rock. The white indurated talc is also found associated with nodules of quartz, the former being disposed in layers round the latter. A blue limestone succeeds in nearly horizontal strata. It contains disseminated talc. We have then a talco-argillaceous schist, and thence siliceous limestone, and white fine granular dolomite in various intermixtures and transitions to the foot of the great Dhuj Peak. Nearly half way up, we observe a talco-calcareous schist in moderately thin laminæ of a yellowish colour, the dip being to E. It is crowned by a purplish grey micaceous schist of well marked character. In descending on the other side, a very beautiful white fine granular dolomite, clouded with green tints, is found, a rock that would furnish a very elegant marble. Argillaceous schist is then established, and continues very nearly to the descent into the valley under Petorahgurh. Limestone then occupies the ground just at the edge of the descent, and on this side the valley, argillaceous schist, as before noticed, is again the rock.

264. It is now time to consider the granite beds, and we may do so in the most regular manner, as well as fill up some details still wanting in the schists, by pursuing a line from Chumpawut to the point where we left off in Art. 231. This route forms almost a straight line, and it is singular enough, that it is parallel to the direction of the mountain land and of the strata, as may be seen by examining the map. Such a coincidence, to say the least, is curious, and cannot fail to excite in a speculating mind a desire to trace in this common relation, some evidence of a community of origin. At Chumpawut, the most eastern of our beds of granite makes its appearance. It would seem to be precisely the same rock that in Cornwall is called granan, being a loosely aggregated amorphous mass, with the ingredients and structure of granite, but so soft, as to bear being dug like clay or mould. It is remarkable for its great proportion of felspar, and small quantity of mica. This soft ground is strewed over with large imperfectly rounded blocks, of a very hard and beautiful granite. It is of a smaller grain than the granan, and much more crystalline. The felspar is white, the mica black, and the quartz yellow or brown. The blocks are sometimes observed to have a superficial layer or crust separating

from them, not in any thing like a decomposing slate, but equally hard and equally beautiful with the body of the mass; nor is it easy to understand, what is the cause of this separation. Some further details will be brought forward when we come to the Dhee bed. At present, we may go on to say, that the eastern boundary of the Chumpawut bed has not yet been traced. To the West, it is succeeded by micaceous argillaceous schist, which passes immediately into well-defined argillaceous strata. These continue to Lohooghat cantonment.

265. It is scarcely necessary, after the long details already given of this rock, to enter into any more; it may be therefore sufficient to say, that it is a fine, granular, grey, compact, blue, chloritic, arenaceous and earthy, most probably the result of decomposition, as though perfectly soft and little differing from clay, it has yet the laminar structure distinctly marked. Near the cantonment in the bed of the stream by the bridge, it approaches to a greywacke, and is full of quartz veins. It contains, I think, felspar, certainly mica and quartz, but the composition is arenaceous. It dips to N. E., and at an angle of 54°. In the cantonment as before noticed, excellent roofing slate abounds, of which circumstance the officers have taken advantage in building. The granular type containing much quartz, and sometimes chlorite, continues as far as the bed of the stream below Furkah. There a quartz rock is seen distinctly stratified, dipping N. E. 15°, at an angle of 54°. This rock contains felspar, and might almost be called a quartzose gneiss. Ascending hence to Farkah, the granan begins to establish itself, till at that place it is perceived that we are arrived at another granite bed, situated almost exactly in the hypothetically drawn line through Chumpawut, parallel to the direction of the strata.

266. The character of the rock which composes this bed, is precisely that already described. The same excess of felspar, the same soft crumbly material, in fact a perfect granan. In the vicinity of Furkah, there is a mass of limited extent, consisting almost wholly of felspar, which it would seem is stratified; but with this exception, the whole of the country for many miles, presents the same roundish projecting amorphous masses. The large blocks are not so common in this tract as at Chumpawut, but towards Dhee they become very numerous, and of enormous size. Here it is that the circumstances of their desquamation may be best studied, and some light thrown on their nature and

origin. The ground is still the same granan, equally soft, equally abounding in felspar as at the two former places; but the blocks are of superior hardness, and have not any sign or trace of disintegration. The crusts may be seen in every stage, just beginning to separate, or having made considerable progress; a large layer, of a thickness seldom exceeding half an inch seems waiting any impulse, or perhaps the further action of the same cause to detach it entirely. These form the only means of obtaining specimens, so hard and so round are the blocks where this phenomenon is going on. The view of the process in all its different stages satisfied me at once that these boulders originated in the granan being but the harder and more durable nodules of a soft rock, which has gradually wasted away, and left them as monuments of the extensive waste the surface has undergone. This view is confirmed by an examination of a very large one that lies to the S. W. of the temple, and which presents a set of appearances worth recording. It is of an irregular sphero-rhombohedral shape, and not less than 60 feet in diameter. It rests on the granan, and its connection with the latter is the circumstance which forms the interest. The block itself is very hard at its base; it is well-defined by a seam which separates it from a layer of a softer granite that is divided by seams into numerous flakes, which all follow the curvature of the boulder. It is not the change of hardness that forms the boundary of the latter, but a distinct seam or separation. The flakes immediately adjoining it are very thin; they gradually increase in thickness as they diminish in hardness, till in a space of five or six feet the seams disappear, and the soft granan of the surrounding surface is established. The rock is in some measure overhanging, the soft layers having been cleared away probably for the purpose of forming a cave or shelter for the numerous flocks and herds that graze here at particular seasons, so that the structure and arrangement of the thing is perfectly exhibited. My figure may give a clearer idea than any verbal description can.

267. The correct boundaries of this granan tract have not yet been fixed on every side, but it is inferred that the extent of it is very limited in a North and South direction. In proceeding to visit the iron mine at Muglig, which is in the latter quarter, I found it pass into a very regular micaceous schist, in a distance of 6 miles. This schist dips to the North, that is, towards the granite, and at rather a

high angle, of 55°. At Kande, a small village about that distance below Dhoora Peak, mica slate is established, and continues to the mine where it contains a bed of limestone, in which rock the mine appears to be situated. Some of the best specimens of calcareous spar are obtainable here, though great part of the limestone itself is very impure, containing 20 per cent. of foreign matter. At the mine, it appears to be stratified, and dips 55° N., at an angle of 34°. The ore is in the form of a vein, to judge from the miner's descriptions. It is of a brownish black colour, granular composition, very hard, and breaks with a conchoidal fracture. It is not magnetic, or at least only very slightly. The specific gravity is 3.7 to 4.0, but as it is obviously contaminated with some foreign ingredient, this determination is too low. It is most probably (the pure part) titanitic iron, (axotomous iron ore.) It is very imperfectly smelted, and sold in a spongy impure state, at the rate of a maund for a Rupee.

268. A remarkable feature in the granan is the number of veins it contains. These consist almost wholly of felspar and quartz, the former mineral forming the larger proportion, for it is always of an opaque aspect, apparently impure, very cleavable, so as to prevent the acquisition of specimens of any size. This structure I think it owes to its impurity, and that it is the intervention of the quartz which occasions its separation into fragments. There are other veins which are to be observed also in the hardest blocks This is a granite of a finer grain, which is sometimes seen to traverse the great boulders, or large round fragments, and they are like most veins separated by a strong line from the surrounding base or ground. Some few imperfect quartz crystals have been found. Epidote has occurred in company with ill-defined large crystals of white opaque felspar; schorl is found in abundance. In one instance it forms a very large vein in a bed of quartz rock. But the most interesting inhabitant of this singular rock is yet wanting to complete its resemblance to the granan of Cornwall. Tin has never been found in it, though as the oxide and sulphuret of this metal are so unlike the general run of metallic ores, it is possible the non-discovery of it may be owing to the ignorance of the people concerning the value or appearance of such mineral.

269. The granite continues to Sarput-ka-Dhoora in a direction a little beyond which it gives place to gneiss, and this to mica slate,

which appears to pass into a greywacke. About half way between this spot and Dhol, (the regular stage,) a number of rocky masses occur, very striking both by their magnitude and apparent disorder. They are all fragments of gneiss strata, one (the longest) has something of a pyramidal shape, very similar to a rock noticed by Dr. Macculloch (also of gneiss,) in Skye. It here performs the part which he supposes the Skye rock would, were it transported to the plains of Hindoostan. It is worshipped under the title of Nag Deo. It is at least fifty feet in height, and twenty to thirty broad at the base, and has no fissure or line of strata, or separation throughout. Gneiss in situ is also found in this neighbourhood, mica slate again succeeds, of an ordinary type, and continues nearly to Dhol.

270. At Dhol, it passes into a singular rock requiring a little detail. This rock is of an earthy composition, and quite soft, though preserving the appearance of strata, and of laminar or schistose structure. It contains in its transitions into ordinary mica slate more or less of this mineral; but in its best defined types very little, if any, is to be seen. It is of various colours: black, red, yellow, grey, white, always bright and well defined. The black is the most abundant, the white the least so. It is very absorbent of water. In a piece weighing 205 grains, it amounted to 28 grains; on another of 191, 30 grains; allowing for the absorption the specific gravity was found to be 1.95 and 2.01. The black variety generally dull, but occasionally with some lustre, is infusible, burning under the blowpipe to a white ash. Some portions, however, do fuse into a black slag, attractable by the magnet. It is slowly soluble in borax, occasioning effervescence, but imparts no colour to the bead. The red variety under the blowpipe turns black, and with a continuation of heat, part fuses into a magnetic slag, part burns to a white ash; muriatic acid, whether concentrated or diluted and even with the assistance of a boiling heat, has no effect. Of the existence of a very large proportion of carbon in this rock, the foregoing particulars leave no doubt. The inference that it contains beds or veins of graphite is a natural consequence, rendered almost certain by the occurrence of the mineral in a similar rock to be noticed afterwards. The great variety of rather decided colours in it gives this district a peculiar appearance. So bright are the reds and yellows, that I think very excellent colours might be manufactured from them. The

people of the country had their attention excited by this circumstance, and attempted to obtain iron from it, which they supposed to be indicated by the red, yellow, and black colours. Failing in this, they do not appear to have sought for any thing else.

271. The micaceous schist again assumes its ordinary character on the road to Bandunee Dihee, and is observed to dip N. E. 25°, at an inclination of 35°. On the summit of that Peak, which forms a plane 200 by 20 yards, strata of garnetiferous schist are seen projecting. The dip 30° N. E., inclination 35°. In the descent to the stream, it changes to a talco-micaceous schist, of a pale lead grey colour, very soft, and almost steatitic, with curved laminæ, and passing into a white clay. It contains nodules and grains of glassy quartz. The dip is North, the inclination 30°. In the bed of the stream, the strata which are of the ordinary character, dip 14° S. of E., the inclination being only 17°. Ascending thence, we have micaceous schist, which continues to the cantonment; the dip being generally between N. and E., and the inclination small. This schist is remarkable for its great variety of type, even within the limits of so small a space as the cantonment; 1. yellowish brown, scaly, tender; 2. quartzose, grey, in tolerably straight but thick slates, the two materials being disposed in layers; 3. less quartzose, in thick large schists, with an undulated surface; 4. blue or dark grey approaching to the character of gneiss, and occasionally containing very small portions of crystalline felspar; 5. a soft arenaceous mass, which on exposure to the air, falls into sand. These are amongst the most remarkable. The addition of garnets introduces many other varieties. This schist is also to be noted as containing veins of granite of a very regular type, and also of felspar in a semi-disintegrated slate, and of snowy whiteness. The latter might be also called a granite, as it contains quartz, and even mica; but the former is in small quantity, and the latter consists of a few solitary scales disseminated.

272. The ridge on which Almorah is situated, rises into the Peak of Kaleenath, and in the ascent thereto the above described schist is observed to pass into the same kind of soft earthy black rock, which was described at Dhol. It was here that the graphite was discovered, (alluded to in Art. 270,) lying on the surface in lumps, the fragments of kidney or egg-shaped nodules. The largest specimen obtained, however, was an oblate spheroid perfectly rounded, and having

a diameter of about three inches. This latter contained small veins of quartz. The aspect of this graphite till scraped or abraded was dull; in the latter case it was metallic. The composition was fine earthy. The fracture uneven, specific gravity —. It appeared to be of a middling quality as applicable to the arts. At the time the discovery was made, I was on the point of leaving Almorah in prosecution of some other views, and I have not since had an opportunity of prosecuting a search after larger supplies by excavation.

273. The mica slate again resumes its ordinary aspect on passing the Peak, and near the village of Betholee has a dip to S. W., being immediately succeeded by a strata of gneiss with a similar dip. This mass is probably connected with that in the valley below, noticed, Art. 269. If so, it would appear to be more of the nature of a vein having considerable longitudinal extent, while a few yards bound it in breadth. In the ascent from the village to the Pass it is again lost, being replaced by micaceous schist. But on the descent gneiss reappears, accompanied by hornblende schist, and extends for some distance. Perhaps after all, these two patches are connected beneath the surface, the micaceous schist of the Pass lying on them. It is possible even that they may both be connected with the Jagesur gneiss, as the latter may be with that observed at Ramesur, and again on the other side with the rock in the valley of the Goomittee. Well devised sections would throw light on this point, and probably develope the general arrangements of these detached patches of gneiss.

274. The Almorah ridge towards the southward, terminates in a mass of granite and granite gneiss, the latter being most abundant. By this term I mean a rock, which in structure seems to be intermediate between gneiss and granite. It is remarkable for containing prismatic nodules of felspar, which gives it a porphyritic character. There is also a good deal of the granan, and there are the same blocks strewed over the surface of the hill as at Dihee. In fact, there is no question but it is the same rock as the two patches observed at Chumpawut and at Dihee. It extends in the east quarter across the valley of the Sowal, ascending the ridge on the opposite side, where it is succeeded by the black and red earthy slate already described, Art. 270. To the south it terminates in the descent to the con-

fluence of the Cosillah and Sowal, being exchanged for micaceous schist, which gradually passes into a talco-argillaceous schist, and latterly, a perfect clay slate. To the westward, it descends the valley of the Cosillah, rising into the lofty peak Seahie Dabee, which is nearly composed of it, and bounded on that side by micaceous schist. A few very narrow veins traverse some of the vallies beyond the limits of this patch, but their connection with it has never been satisfactorily traced.

275. The micaceous schist of Almorah occupies the descent to the Cosillah, with the exception of the narrow strip of granite just noticed. The road to Hawulbagh is in the same rock, and it continues in the route up the valley of the Cosillah, till it is exchanged for the patch of gneiss noticed in Art. 152. On the road to Gulee Busoor, it also prevails, being most commonly of a bluish colour, and containing garnets abundantly. This rock is further remarkable for being traversed by a vein of a singular nature, no name or description of which I have even met with. Near Hawulbagh an instance occurs: It is of a porphyritic character, consisting of thin needles or prismatic bundles of needles of hornblende, imbedded in a white granular paste of felspar and quartz. On the Pass above the village of Aeena, leading from this valley into that of the Sugos, the rock is of an earthy type and very singular aspect. The dip of the schist here (on the Pass) is N. E. 22°, the inclination 50°. Below the village of Aeena, it occurs of a lead blue and full of garnets, the dip being N. E. In this neighbourhood are many of the porphyritic veins just noticed. Micaceous schist more or less differing in character continues to Mernee, near Dhooara Hat'h, great irregularity being observed in the dip with frequent reversals; near the Sugos it is S. W., which on going a little farther is exchanged for a N. E. dip. In the bed of the river it is again S. 25° W., inclination 34°. The porphyritic veins are abundant in this neighbourhood. The S. W. dip continues to the junction of the mica slate, with a gneiss which lies conformably; but which is the superior rock, it is impossible to say for want of access to the line of junction, especially as the change takes place in the direction of the strata.

276. This gneiss is introductory to a large patch of granite similar in character to the three beds already described as occurring at Chumpawut, Dihee, and Almorah, and what is still singular, in the same straight line with them; the direction as before observed, being parallel to that

of the strata and of the mountain land. There remains nothing to add to the particulars already given of this rock at those places, as it is here precisely the same in grain, consistency, overlying, amorphous appearance, &c. It appears to pass on its borders into a gneiss. The change at Mernee has just been noticed. Another takes place in the descent to the glen to the N. W. that leads into the valley of the Ramgunga, (Art. 106.) To the N. E. it is I think connected with the gneiss in the Cosillah, (Art. 152.) To the south it is succeeded at no great distance by micaceous schist, but the boundary line was not seen. The schist was observed to dip N. 27° E., inclination 41°. To the west it passes into the pseudo-porphyritic gneiss, noticed at Almorah, and which near Mythana is succeeded by a black micaceous schist. Near Palee, however, the gneiss is again seen, containing nodules of quartz, and some very singularly lustruous veins of a material, the same essentially as the basis, only much harder. At no great distance on each side, micaceous schist is recognised.

277. In the descent to the Ramgunga, micaceous schist reappears, and continues as far as the confluence of the Beneegunga. In the bed of the former river, the number, size, and variety of the rolled stones is quite surprising. They occur at a height of 200 feet above the present bed of the river, and many of them are of a totally different nature from any of the rocks in the immediate vicinity. The micaceous schist continues in the Beneegunga; at its mouth it dips 32° N. E., the inclination 31°. Beyond Tamba Dhar, it is again succeeded by gneiss, which is distinctly stratified, and dips N. to N. 13° W., at an angle of 52° to 57°. It is worthy of remark, that part of this rock is a perfect micaceous schist, containing no visible traces of felspar, yet there is no separation, nor any transition in the usual sense, nor disturbance of any kind. To the eye, it seems to be part of the gneiss, but on examining it, the characteristic ingredient is found wanting, while in the remainder of the mass, it is obvious enough lying in lenticular imbedded nodules, which on the cross fracture, give the rock an appearance not to be mistaken.

278. Another observation of the dip, a little beyond this point, gave N. 22° W., the inclination 43°. Quartz rock and micaceous schist next succeeds, and continues to Deoghat. At this place, the route turns up the bed of a feeder of the Beneegunga to Ketureea, and in

this line a rock oscillating between granite and gneiss continues the whole way. It appears to divide into cuboidal masses, or rather into parallelopipeds, one of the surfaces of which, apparently coinciding with the planes of the strata, gave a dip of N. 22° W., inclination 36°. Near the Dawk chowkee, it is observed in immense rounded masses lying in the bed of the river, and I think having more the character of granite than the masses in situ. In this the felspar, which is of a greenish grey colour, and its lustre being highly translucent, is very remarkable for the size of its concretions, and their imbedded appearance giving the rock very much the appearance of a porphyritic granite. This rock has an analogue at Almorah, and on the summit of the Choor Peak.

279. The gneiss continues to put on the appearance of being divided by several sets of seams into more or less regular masses, and its structure becomes less decidedly schistose. An observation of the dip gave N. 10° W., with an inclination of 72°. It contains the same felspar that I have just noticed as occurring in the rolled masses of granite, a little beyond the 243rd kos stone* the dip was observed S. 20° W., inclination 50° to 60°. Latterly near Thanna, it gives way to a micaceous schist, remarkable for the great size and imperfect shape of the garnets it contains. The round blocks of granite of great size appear still in the bed of the river. From Thanna to Muse, and again in ascending the high range over which the road to Ran leads, no rock but micaceous schist is seen in situ. Above Masoo, it occasionally contains kyanite, but not in any quantity, or of any size or beauty of appearance. On the summit of the Pass, the same rock is found dipping N. E. at a considerable angle. Half way down the descent, blocks of gneiss in great number and of great size are seen, many of them occupying such situations as will not admit of our supposing for an instant, that they have ever been in motion, or occupied other than their present sites. At the village of Ran, micaceous schist is the rock dipping N. E.

280. From Ran, the route descends to the bed of the same nullah in which micaceous schist is still observable, and thence ascending to Kunyoorbut near the latter place, we come again upon a district of gneiss

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* The Goorkhalee Government had erected these stones at distances of a koss along the line of road from Katmoondo to the Sutlej.

rocks, which occasionally appear to pass into the common earthy micaceous schist, occasionally into an amorphous granite. It contains schorl occasionally in nests. The boulders are very numerous, and the granite is in places a perfect granan. The gneiss, when well defined, contains garnets. Hence to Dhout, the latter rock and micaceous schist may be considered the prevailing rocks. On the summit of the Pass above, gneiss is also found of that type, which inclines rather to micaceous schist than to granite. Hence descending, the granite is again met with, but under relations which will bear a little more detail.

281. The appearances I am going to describe may be seen a little to the east of the village Dhooeet. In a geological sense, the rock may be called a gneiss, but it exhibits small patches, (forming regular transitions amongst themselves,) of the most regular micaceous schist, (earthy type,) and again of the most legitimate granite, (granan). These three rocks, so different in composition, in mineralogical character, and in supposed geological origin, may be here observed in the compass of a few yards, all naturally interchangeable, while nothing like a veinous appearance can be attributed to any of them. A long zone or belt is marked by huge boulders of gneiss or granite, (for I could not examine them closely,) strewed over it, and such is the declivity of the mountain side, that we cannot for a moment suppose that they have rolled into their present places. They are in fact like those of Dihee, the harder nodules of a rock many feet in depth, which has disappeared owing to the power of waste. The dip of this rock, which in its gneiss and mica slate types is regularly stratified, is N. 48° to 55° E., inclination about 48°. In the descent from this village, we find the chloritic argillaceous schist mentioned in Art. 116.

282. The whole of these beds are upon the same line, which is, as before observed, parallel to the direction of mountain land and of the strata. In prolonging this line to the westward as far as the Sutlej, only one other locality of granite is met with*. This is the Choor Peak, a mountain which rises to the height of twelve thousand feet, and which has no equal or rival within a circle of sixty miles diameter. The shape is that of a long block or ridge running N. N. W. and S. S. E., about one and a quarter mile in length, which rises suddenly on the N. W. extremity into a sharp rocky peak many feet higher. To the S. E., it sinks suddenly into a well-wooded range, where the

rock is with difficulty accessible, but from the indications observable, I should judge it to be micaceous schist. This rock indeed surrounds the base of the high ridge which itself is composed of granite, occasionally of a highly crystalline grain. It appears to contain two different kinds of felspar, one of which assumes that arrangement which may entitle the rock to the appellation of porphyritic. It is a very beautiful rock. The mountain is conspicuous from every other quarter, and in every view of it the summit patch of granite is at once distinguishable from the micaceous schist below by its peculiar rocky aspect and bareness.

283. I have now to give a few details on the occurrence of the sandstone formation which bounds the mountain tract to the South towards the plains. This rock assumes many different aspects here as it does in Europe; upon the whole, the resemblance is sufficiently striking to allow of our identifying it with the newer red or saliferous sandstone, (the red sandstone of English geologists.) It is either a hard red gravelly clay distinctly stratified, or the same clay enclosing rounded stones, or a micaceous sandstone, which in hardness varies from loose sand to a rock that will strike fire. This type is again modified by the admission of rounded pieces passing into sandstone conglomerate. These two rocks form the principal part of the formation. The sandstone is always micaceous in a high degree; it is most commonly of the ordinary colour, but sometimes it is found of a dark bluish grey, in which case it seems to loose its appearance of a schistose structure, and becomes amorphous, breaking equally in every direction. The type is farther remarkable for containing kernels of superior hardness to the base, which itself is more compact, and I might say clayey, than the ordinary sandstone. It also contains less mica. This grey type also passes into the conglomerate structure; besides these, which are the most marked types that have any extent, there are innumerable varieties of very anomalous appearance, chiefly towards the upper part of the rock. The yellowish grey ordinary sandstone often alternates with a rock that might pass for a perfect greywacke. The latter is seldom marked with the strata lines like the sandstone, but is conformable and parallel to it. One of the most remarkable features is the occurrence of ellipsoidal-shaped cavities in the middle of sandstone strata. They are of different sizes. One which I observed measured six feet in its longest diameter, and was quite smooth and regularly curved in its interior.

284. I shall now mention the different places where this sandstone has been observed, adding any other particulars which appear to require it. At Bhumowree, it is seen in the river bed, dipping N. E., at an angle of about 30°; but it has here scarcely any development, and nothing is to be learned regarding it but the above fact. At the Chilkein defile, we have more access to it. It there forms very extensive strata, chiefly of the red clay type, between Chilkee and Dhikoolee. In the bed of the Cosillah, occasionally rounded stones are contained imbedded. The strata appeared almost horizontal, or at least very slightly inclined. At Dhikoolee, the conglomerate character is perfect, the basis being still the red clay, but sometimes indurated in a high degree. The strata here dip to the North. They are covered by a deposit of loose rounded stones. From this point, the rock is concealed till we reach Chookoom, and there we find a greenish grey sandstone with mica dipping S. W. It is covered by a loose shattered rock of various bright colours, indicative as I have observed elsewhere, of this formation; beyond this point, that is above it, I have not met with it.

285. Specimens brought from Kaloo Shaeede's tomb, at the outlet of the Ramgunga, belong to this sandstone. They were of the grey type, with conglomerate structure. At Hurdwar, it may be studied to great advantage, and all its characteristics examined on the Beemghora Pass, where the construction of a beautiful road, by order of Government, has given two admirable sections of these strata. They are here mostly of the sandstone type, neither the red clay or the conglomerate being common. On the opposite side of the river, however, Chundee Puhar is almost entirely composed of these types. A singular circumstance is the opposite dip of the strata observable at these two places. At the latter, they dip on the Hurdwar side S. 35° W., at an inclination of about 30°; while on the other the dip is the N. E., the inclination much the same.

286. This formation has also been examined in the Kheree Pass, leading from the Dhera Doon into the plains. In this quarter, the dip is very regularly to the N. E., or to some point between N. and E. The first strata observable, and which may be supposed uppermost, is the red clay that lies on a stratum of red conglomerate. The Pass is cut through this latter, and a good section of it obtained. The stones are most commonly quartz rock, more or less coloured; pieces of granite

also are observable. Farther on is a perfect sandstone conglomerate; specimens were obtained in appearance perfect greywackes, traversed by quartz veins. The grey type is common, and often appears to pass into a sandy clay, with mica disseminated. Similar phenomena are visible in the Timlee Pass, the other entrance to the Dhera Doon, and in the ascent to Nahun. The Pinjore Doon is shut in to the southward by a low range of hills, composed chiefly of red clay and red conglomerate. West of this point, the formation has not been traced, but it probably extends to the Sutlej, having a greater development where the vallies separate it from the primary strata, and vice versa.

287. There now only remains that I should notice the extent of the deposits, consisting of rounded stones, gravel, and sand. I have already mentioned in the course of the preceding details, the several accumulations that are to be observed in the beds of rivers. But their greatest extent is on the borders of the plain country lying at the foot of the mountain ranges. At Bhumowree, they may be seen resting on sandstone. They reach to Tandaha, a distance of fifteen miles. In great part of this line, the deposit is of enormous thickness, a well having been sunk half way between those places to the depth of 150 feet, without passing through it. At Chilkeeah, they are again seen reaching from the foot of the mountains to Haldoorea, a distance of twelve miles. Here also the deposit must be of great thickness, as ineffectual attempts were made at Chilkeeah also to sink a well; sixty feet was the depth penetrated to, without passing through them. Again at Hurdwar, they have been traced as far south as Bhogpoor, a distance of ten miles, pieces of granite being observable amongst them. On the Kheree Road, they are seen for an equal distance to the southward, and on the Beput Road the same. But the most extensive collection of them by far is in the Dehra Doon, the whole of that valley being, as it were, filled up with them. A well which has been sunk there by the Hon'ble Mr. Shore, attained a depth of 220 feet, before a good and plentiful supply of water was met with; even at that great depth, the nature of the deposit was the same as at the surface. Mr. Shore has preserved notes of the particulars observed in the course of the work, and has kindly allowed me to take a copy of them. I shall here give them, as forming a very interesting contribution to our knowledge of the geology of these mountains:—

Feet.	*Total.*	
5	5	Fine black mould, with a few stones.
4	9	Reddish earth, mixed with gravel.
9	18	Loose sand and gravel, large stones.
2	20	Ditto, with reddish clay.
3	23	Stiff reddish clay.
8	31	Stiff yellow clay.
3½	34½	Sand and gravel, mixed with a little red clay.
1½	36	Stiff reddish clay.
2	38	Sand and gravel.
22	60	Stiff red clay.
2	62	Clay sand and gravel mixed.
16	78	Sand and gravel.
12	90	Stiff yellow clay, with a little sand.
35	125	Sand and gravel, a few round stones.
3	128	Sand, large blocks of conglomerate north and west side.
3	131	Ditto.
13	144	Sand and gravel, with tolerable sized stones.
5	149	Ditto ditto, stones larger.
9	158	Ditto ditto, with pieces of conglomerate.
4	162	Ditto ditto, with enormous stones.
6	168	Conglomerate on three sides, gravel the fourth.
3	171	Sand and gravel most; occasionally pieces of conglomerate.
3	174	Conglomerate, blocks of.
3¾	177¾	Layers of sand and gravel, pieces of conglomerate.
4¼	182	Sand and gravel.
⅓	182⅓	Conglomerate 4 inches thick, under it water, but scanty.
2⅔	185	Sand and clay.
⅓	185⅓	Conglomerate.
18⅔	204	Sand and gravel, rather loose, occasionally pieces of conglomerate, occasionally solid blocks 160 ℔s. in weight.
5	209	Sand and gravel, very moist.
⅓	209⅓	Conglomerate, over half the well water.
1⅔	211	Red clay.
7	218	Sand and gravel, very moist, water.
3½	221½	Blackish clay, with angular fragments of clay slate.

288. The extent of these deposits has not been traced so recently to the westward, but no doubt is entertained, that they attain there also an equal extent, judging from the recollection of former journies. Below Nahun in particular, and near Munta Dihee, at the exit from the Pinjore Doon, very clear traces of them are to be seen. That the Pinjore and Kyarda Doons are, equally with the Dehra Doon, composed of them, I have no doubt. It ought to be stated, before concluding, that in the Dehra Doon, the great thickness appears to be in the centre where the ground is highest. Towards the vallies of the Ganges and Jumna, they diminish very much in thickness, and in the beds of those rivers, may be observed resting on sandstone.

289. Southward of these rounded stones, a very extensive deposit of the red clay, which is very similar to the red strata of the sandstone, prevails. It has often small patches of loose sand. This red gravelly clay lies in a blackish clay of a purer character, very stiff and tenacious at different depths in different places. This latter appears to change to a lighter colour as we descend, and becomes more arenaceous, till at length it changes to a grey sand. My enquiries and observations have not yet been sufficiently general to allow me to identify these deposits with any thing like certainty, indeed it is only very lately I have been able to turn my attention to the subject, and the recent arrival of the boring engine I had ordered from England, precluded the possibility of constructing a proper apparatus and scaffolding for using it with effect, unless the operations were delayed till the ensuing year. I was therefore obliged to content myself with such results as could be obtained without the proper means, and was not able, in consequence, to penetrate beyond twenty-two feet in any of the bores I made; but I hope on my return to the field duties, that I shall be able to continue these enquiries with greater effect.

290. In the meantime, it may be interesting to give the particulars of the few bores I made. The first was at Moradabad, but being new to the operation, it took several days to bore sixteen and a half feet, the particulars were as follows:—

Feet.	*Inches.*	
4	0	Superficial sandy loam forming a very productive soil.
2	5	Brick earth. This is the red clay, which prevails so extensively in Rohilkund, and which so often comes to the

Feet.	*Inches.*	
		surface, forming a substance of a singular hardness, and excellent materials for roads.
3	7½	Reddish micaceous sand. The temperature at this depth 16½° was found to be 76° 5′; a thermometer in the shade marking 58°, and the surface of the ground being 56°.

291. The next boring was at Kusherpoor, where the red clay has a very extensive superficial development. It forms the step described in Arts. 59 and 73, which gives so deceptive an appearance to the direction of the fall or declivity. The spot where the boring was made, was about twenty feet below the surface of this red clay, and the following were the particulars :—

Feet.	*Inches.*	
2	3	The superficial red clay.
1	3	Green sandy clay, water.
4	6	Black clay, extremely tenacious.
1	6	Light blue sand. The water was in such abundance, as to prevent any further progress; it speedily rose to within a few feet of the surface. At Huldoon, seven miles north, nearly similar results were obtained.
5	6	A ferruginous sandy clay or loam, latterly becoming more stiff.
1	6	A greenish clay, getting latterly blackish.
2	0	A bluish grey clay, partially sandy, not so tenacious, and quite moist. Gravel under this. The water rose rapidly, and prevented any further proceedings.

292. At Jusspore, nine miles N. W. from Kusheepoor, a third boring was made, but the place was injudiciously chosen, being in a hollow, evidently the dry bed of a jeel. The following are the particulars :—

Feet.	*Inches.*	
5	0	Surface sand, which gradually changes to a stiff red clay.
2	0	Red loose sand, damp.
2	0	Variegated sand and clay, spotted.
3	0	Yellowish sand, changing to light grey, twigs and roots were found at nine feet, water at 12.

293. At the next place we find the same deposits as at Kusheepoor and Huldoon.

Feet.	*Inches.*	
2	0	Superficial loam.
3	6	Clay; temperature 68°.
1	6	Sand.
1	6	Clay again.
1	6	Sandy clay, twigs.
2	3	Stiff clay, latterly blackish.
1	6	Ditto, of a darker colour and more pure.
1	0	Grey sand.

Water rose to within a few feet of the surface.

At Afzulgurh, the following particulars were noted:—

Feet.	*Inches.*	
6	0	Superficial loam small nests, and veins of a semi-carbonised vegetable matter.
2	6	Red sand, a quicksand.
4	0	Blackish stiff clay.
3	6	Stiff clay, latterly sandy.

The quicksand falling in prevented any further operation. The black clay proved to be an excellent potter's clay, and baked without changing colour. It formed a very porous article, and was very acceptable to the potters, who were ignorant of the existence of any such clay in their neighbourhood.

294. At —— the following particulars were noted:—

Feet.	*Inches.*	
7	6	The superficial loams yellowish, and more sandy latterly. It forms an excellent soil, and is known by the provincial term *muteear*.
2	3	White micaceous mixture of sand and clay.
1	6	White clay, a little sandy.
1	0	Brownish black clay, containing semi-carbonised vegetable matter.
2	6	Dark bluish clay, very stiff, when wet almost black, latterly veins of light blue.
6	0	Clay much iron shot, and passing to sand.
1	6	Dark bluish clay, as before.
5	0	Sandy clay, much iron shot.

The temperature was observed to be 73°, once at six feet, and again at eight feet, that of the surface being 59°.

295. I have here concluded the geological details; some few particulars have been omitted in their places, but will be hereafter inserted with fresh matter, which I hope will render it something more complete. I have principally to regret, that the circumstances under which these papers have been prepared, have prevented the execution of the original design of referring in the account of the occurrence of rocks by number to the particular specimen collected. Such a practice will be of very great advantage, and will indeed give the above detail far more authority, than it could possible otherwise have. I shall now proceed to state, in a few words, the general results to which they lead.

Section III.

RECAPITULATION.

296. In the details just given, I have necessarily entered into a minuteness of description, which to the general reader must be tiresome in no small degree. The paper being intended as a record of observations, it was necessary to be particular; but I shall attempt in this section to throw together the general results, comparing them afterwards with received opinions, and illustrating the whole in the best manner my limited reading will permit.

297. It appears then, that in these mountains gneiss occupies the greater part of the surface, forming a band of 24 miles in breadth, and including within its boundaries all the elevated summits, but one, of the table, at Art. 39. Of these all that have been approached sufficiently near to determine the point are certainly gneiss, that is, if distinct, thin, and well-marked strata be any ground for deciding. Other evidence there can be none, as it is impossible, by actual examination, to ascertain what rock is at the summit. It rises then most probably to the height of 25,709 feet,* while the lowest point is only elevated 2,800.

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* Captain Webb gives 25,669 as the height above the sea—Journal of Science. The paper by Major Hodgson and myself in the 14th Vol. As. Res. has 25,749. I have taken the mean.

If we suppose the lower strata continuous across this tract, and allow for the inclination, we shall have eight miles for the extreme thickness of this formation, and about six for its mean value.

298. The direction of this zone of gneiss is generally, I might say almost always, North 60° West, being thus parallel at once to the direction of the line of greatest elevation, and also to the general bearing or tendency of the mountain land. The inclination lies between 20° and 30° in by far the greater number of instances. It is, however, sometimes, though very rarely, as high as 50°, and in one solitary instance was observed to be 56°. There are very few reversals of the dip, at least towards the centre or middle of this zone; but along the southern boundary, which is very irregular in its outline, forming various incursions into the adjoining zone of schists, there do occur several irregularities both in dip and inclination, and the former is sometimes reversed. That it is pretty regular in general, however, is proved by the fact noticed by all travellers, of the uniformity of aspect in the sides of slopes and precipices in these mountains.

299. The character of this rock is highly crystalline, and it appears to consist almost always of the regular ingredients, and united in the usual regular proportions. It is surprising how few varieties present themselves in so extensive a tract of country, and in general, these varieties differ more in colour and grain than in mineralogical character. The occurrence of imbedded minerals is rare, and of these, only, the most common have been observed, as quartz, garnet, and kyanite. It is almost equally barren in beds, containing only some very small ones of hornblende rock, quartz, limestone, and mica slate. Of the two last, I do not know more than one or two instances of each. In fact, there is a character of sameness throughout this formation, extremely tiresome to the geological traveller, as continually disappointing him in his hopes of meeting with something new and interesting.

300. Veins of granite are numerous, particularly towards the central or highest parts; but no beds have yet been found, the granite of Wongtoo being supposed to be veinous. Towards the boundary, however, there are some patches, which would appear to have some connection with a series of beds found beyond the limits of the gneiss, and surrounded generally by rocks of a more earthy and less crystalline character. These latter beds have been described as occurring at

Chumpawut, Dhee, Almorah, Shaee Debee, Dooara Hath, Palee, Dhoeet, and Kunyoor. They are situated in the zone of minimum elevation, and a line passing through them has a direction of North 60° West, the same as that of the strata and zones of different elevation. West of the Ganges, no such beds are found, unless we suppose the Choor granite, (which is certainly on the prolongation of this line) to be one, and then it will be the only one. Another anomaly which the granite of the Choor presents is, that it occupies the highest point in all the mountain tract, south of the zone of greatest elevation, whereas the eastern beds are situated in the lowest ground. A third difference is in the character of the rock, which in the case of the Choor granite, is highly crystalline; in most of the others, earthy and decomposing. Yet it must be confessed, that they present some differences of aspect in this respect, and that at Chumpawut, Dhee, and Almorah, very hard and crystalline granites are procurable, though at the two latter places in limited quantity.

301. The grain of the veinous granites is, as has been often remarked, large; in variety of composition too, they form a singular contrast to the uniformity which distinguishes the gneiss. In this respect, they also differ from the beds of granite, which are strikingly alike in mineral composition, colour, and size, and arrangement of grain. In these particulars, the Choor granite is almost precisely that of Almorah, though separated by such a wide interval. What distinguishes this granite at first sight is, its porphyritic structure, and it evidently contains two distinct varieties, if not species of felspar.* This variety is seldom found in a crumbly decomposing state. The only other well defined type is that which is so remarkable for its rapid disintegration, in which the ingredients appear to be united in the usual irregular manner. This contains a large portion of white opaque felspar, and it is well distinguished by its granite boulders, the true nature and history of which have been so well laid open by Dr. Macculloch.

302. Smaller veins have not been observed to affect the appearance of the including rock, but the vein at Wangtoo, the only large one

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* The existence of several mineral species hitherto confounded under this title, has been now clearly established, and I anxiously look forward to a period of leisure, when I may submit the different granites to a particular examination with reference to this point.

I have seen, certainly is in contact with a rock forming a transition between granite and gneiss. With regard to the beds, they also present in general the appearance of a thin band of gneiss surrounding them, and outside of this is found mica slate. The whole being included in clay slate, no change in the latter rock has even been observed. It is almost unnecessary to say that none of these beds are stratified,* that is, the central nucleus; but as before stated, they appear to pass into gneiss on their boundary. The only imbedded minerals are schorl and quartz, (rhombohedral schorl and rhombohedral quartz.)

303. Conterminous with the gneiss may be found a series of different rocks all possessing the schistose structure, micaceous, chloritic, and talcose schists; whether all to be included under one head, is a point for the determination of which data are as yet wanting. But it is perfectly certain, that there is no such thing as a general and continuous formation of micaceous schist (the next rock in our systems) analogous to that of gneiss; several large patches of micaceous schist occur, but they are separated by equally large tracts of other schists. Perhaps the above three schists might be conveniently considered as one formation, although we should even then find our systematic views disturbed by the intrusion of schists of an argillaceous character. These latter may be seen even in contact with the gneiss. Thus we shall be forced to modify a little our ideas of the exclusive nature of formations, and in admitting argillaceous schist as a member of the series, we shall establish, as succeeding the gneiss, a zone of schistose rocks of nearly equal extent, but not presenting the same appearances of regularity of position, or uniformity of mineral composition.

304. In considering the subject, I have been certainly inclined to view this latter account as most consonant with the phenomena. But it is possible that a more particular examination of the boundary of the gneiss may establish the first view, and in this case, the gneiss with which the argillaceous schist is in contact, would belong to a different era from that of the zones of greatest elevation, whereas I have suppos-

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* The stratification of granite, a favourite tenet of one of the rival schools of geology appears to be losing ground every day. Mr. Greenough long ago, in his critical examination, shewed the extreme laxity with which this term stratification had been used. In the sense in which most unlearned people understand it, I apprehend that granite can never be said to be stratified. After all, however, it is a mere dispute about words, and seems, whichever way determined, to throw no light on the subject of the origin of rocks.

ed them to be connected. This is one of the difficulties attending so early an attempt to generalise; for the present it may be sufficient to view all these schists as constituting one formation. This formation will then be found to be of nearly equal extent with that of the gneiss, being in breadth — miles, and stretching, as that does, from river to river, it will terminate in those mountains which form the northern boundaries of the several Doars, and in the line connecting them.

305. In this method of viewing these rocks, it may be stated, that there is but one general formation (of primary rocks,) besides that of the Himmalaya gneiss,* and it is worthy of remark, that they divide the whole tract pretty equally between them. The schistose formation is no doubt stratified, though, it is thought, not so regularly as the gneiss, and its strata are often much more inclined, much more contorted, and present greater irregularities, both of curvature and reversal of the dip. It is, however, to be noted, that mountains of this formation do not present the same facilities for examining the strata, as those which are composed of gneiss. Being in general so much more subject to decay, they have a very thick bed of local debris which effectually conceals the rock in situ, and in such cases, the character is necessarily taken from that of the debris. The effect of this is to give these mountains a rounded and softened contour, which distinguishes them at once from the serrated and bare rocky ridges of the gneiss formation.

306. The mineralogical character of these schists is variable; but this is not only true of the whole formation, viewed as comprising rocks to which distinct titles have always been allotted, but also of the varieties which are referable to any one of those titles. And the many anomalous rocks produced by the intermixture, and transitions of these, form a numerous band, strictly speaking, belonging to none of them considered by itself, and therefore strengthening the view I have taken of the

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* In confining the number of primary formations in so extensive a tract to two, I may be thought to indulge in too large a generalisation. It may be said, that many of the beds I mentioned as contained in the clay slate, may be in fact formations. It is proper, therefore, that I should explain what I mean by a bed; for half our mistakes in geology are occasioned by using words in a wrong sense, frequently in no sense at all. By a bed then I mean, a mass not veinous, which is surrounded on every side by the same rock. It may be stratified or not; it is unnecessary to add the term subordinate, as this definition includes that idea. It has another advantage, that it involves no theory.

entireness of this formation. These varieties, at least all those that required it, have been described already with sufficient minuteness. It may be here a sufficient recapitulation to say, that the argillaceous schist, as it covers the greatest extent, so it presents the greatest vacillation in character. No opinion can be more void of foundation than that which supposes the several varieties of clay slate to be arranged under four different, distinct, and well marked types, the produce of four different eras, and distinguishable by characters mainly dependent on colour; so far from dividing into regular zones, or even isolated patches, the different varieties are found in every part of this extensive tract. Excellent purple roof slate; stone slate passing into flinty slate; a black almost arenaceous rock, with patches of white resembling the ash of half-burned charcoal; a white arenaceous rock with scales of mica; a soft schistose clayey rock of various bright colours, and a granular yellow rotten stone; all these are found in a space of not three miles square. From my own very limited experience, I would say, that of all distinctions, colour in clay slate is the most vague, and least to be depended on.

307. This tract of schists contains numerous and extensive beds of limestone, frequently enclosing veins of galena, (hexahedral lead galena of Mohs,) beds of dolomite (macrotypus lime haloide,) and potstone (prismatic talc mica, the massive variety,) either singly or in conjunction, and containing in each case veins of copper and iron pyrites, (pyramidal copper pyrites and hexahedral iron pyrites,) purple and grey copper (octahedral copper pyrites and tetrahedral copper galena,) beds of red and brown iron ore (rhombohedral and prismatic iron ores,) veins or beds of graphite, (rhombohedral graphite mica,) and superficial amorphous masses of gypsum (prismatoidal gypsum haloide.) But the most remarkable of all its subordinate mineral masses is the greenstone, which is so often met with, though limited as to extent. Connected probably with this rock is the series of fragments, obtained near Bhumowree, presenting types of amygdaloid and porphyry. But the whole subject is as obscure, from want of observation, as it is interesting, and the fact of the only series of lakes within these mountains being found in the neighbourhood, enhances the interest extremely. Indeed, it is not a little difficult to restrain our premature efforts to connect these facts with a well-known theory, remarkable for the origin it assigns to these rocks.

308. Southward of the great belt of argillaceous schist, which forms the plainward termination of the series of schists, we find a narrow strip of secondary rocks, mostly, if not entirely, the newer red or saliferous sandstone. This formation presents little to interest us, excepting in the promise which its position here gives of more valuable deposits further South. It is always stratified, and the dip is most commonly conformable to that of the primary strata. At Hurdwar, the strata on opposite sides of the river dip in opposite directions. It differs extremely in character, being sometimes a red clay, which occasionally contains rounded stones, sometimes a regular sandstone conglomerate, often loose sand. It is remarkable for the quantity of mica it contains, and for the series of bright colours it presents often within a very short distance. It contains brown coal (bituminous mineral coal,) but in what quantity is not known.

309. Lastly, we have lying at the southern foot of this sandstone range, and also occupying the several vallies bounded by it, a deposit of great depth, but not disposed in strata, consisting of gravel and sand, including large boulders or rounded stones of every magnitude up to three feet diameter. The extent of this diluvium, as we may call it, is very great, it occupies a track 192 miles in length, and nearly 10 in breadth. But the length is probably much greater, as it is not unreasonable to infer, that it is conterminous with the sandstone range, which certainly extends from the Indus to the Burhampooter. Outside of the tract of diluvium, a red earthy marl is found intermixed with patches of sand, and a blue clay, very similar in character to that of the London clay, is found to underline these. In the neighbourhood of Hansee, a fresh water limestone is met with, containing perfect shells of the genera melania and planorbis.

CONCLUSION.

SECTION IV.

310. From the particulars given in Section I, may be collected the fact of a considerable difference of physical aspect between these mountains and the Andes, the chain with which it has been most usual to compare them. Instead of the confused and irregular appearance, the

endless and complicated ramifications, the ragged and steep acclivities, the total absence of vallies or level ground, the lofty summits and deep ravines there described, we have in the latter an arrangement of two parallel chains or ridges running for a distance of 500 miles, and enclosing between them a broad and elevated table land, constituting one of the finest countries in the world; again the numerous volcanoes, extinct or igneous of the Andes, the terrible earthquakes, the torrents of mud and water so frequently discharged from openings suddenly occurring, and the uprising of considerable mountains; all these circumstances belong to a totally different order of things from that which prevails in the Himmalaya.

311. The difference in physical features is not greater than that which appears in the geological character of these two rival chains. In the Andes, as we learn from Humboldt, there is an extraordinary developement of porphyry and trachyte, the more elevated points being composed almost exclusively of the latter rock. Trachyte is confessedly a volcanic production, though the rival schools are at variance with regard to porphyry. Yet, M. Humboldt in his latest work, appears to incline to the opinion of its also being of igneous origin.* We may further notice the great deficiency of primary formations.† Granite and gneiss are only found in masses of any extent near the sea coast and at low elevations, while the transition clay slates and secondary sandstones attain a developement and an elevation, of which there are no other authentic instances.

312. In the Himmalaya again, we have seen that neither trachyte nor porphyry, nor indeed any volcanic or trap rocks are to be found. The whole series, as is evident from the details in Section II., is composed of primary formations, and chiefly if not entirely of gneiss;

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* Or ought we not rather to admit that the domain of volcanic action has been too much limited, and that these porphyries are, with respect to their origin and relative age, connected with trachytes, as the trachytes formerly confounded with trap porphyries are connected with basalts, and real lava ejected by burning volcanoes? Humboldt Gisement des Roches, English Translation, page 157. Again, "In Equinoxial America, the limits between transition porphyries and real trachytes known to be volcanic rocks are not easy to fix." Idem, page 155. For other instances of this opinion, see page 156 to 160.

† In the Cordilleras of the Andes, of Peru, Quito, Grenada and Mexico, among that innumerable variety of porphyritic rocks of which the masses attain from 2,500 to 3,000 toises in thickness, I did not see a single porphyry that appeared to me decidedly primitive. Humb. Giss des Roches, English Translation, in p. 124.

succeeded on each side by an extensive band of schistose rocks, enclosing a variety of subordinate beds, the whole being of the clearest primary character. Organic remains are, it is true, stated to have been found at a great elevation northward of this chain, but nothing of the kind occurs within the zone of greatest elevation, nor within the mountain tract south of it. It is, however, believed, that with regard to the great elevation of the transition and secondary formations, parallel examples to those of the Andes may be found in the prolongation of the mountain barrier to the north. The subject has not yet been fully investigated, but there are presumptions in favor of this opinion deducible from the arrangement of the strata. The following particulars may be stated as the sum of what is actually known on the subject :—

318. No organic remains have even been found within the tract which I have asserted to consist of primary formations. But they have been brought from a place north of the zone of gneiss, and though there are doubts as to the localities of some of these specimens, it is quite certain that in one instance, ammonites have been observed in great numbers, at an elevation exceeding 16,000 feet.* What makes this occurrence particularly interesting is, the fact of the limestone in which these ammonities are found occurring at no great distance from the boundary of a gneiss, which if it be not actually connected with, is not distinguishable in mineralogical character from that of the Himmalaya.

319. Ammonites, mineralised by clay slate, have been brought by natives, and as they aver, from no great distance from our frontier on the Neetee Pass. I have also seen specimens of belemnites mineralised by calcareous spar.† But neither these, or the preceding more authen-

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* I have never had an opportunity of examining these fossils, but the identification of the species would throw no light on the question which is here being considered, as it is generally agreed by geologists, that however uniform the mineralogical character of rocks may be in the most distant localities, yet with regard to organic remains, no assistance can be derived from the *characters of species* in identifying formations, unless in a country of very limited extent. Even the hitherto generally received opinion of the universality of formations begins to be questioned, and a doubt entertained whether the granite of Cornwall, for instance, and of these mountains were formed or even assumed their present places at the same time.

† It has been made a question by a geologist of deservedly high reputation, whether the occurrence of organic remains (speaking generally) should be considered *ipso facto*, a decisive argument against the primary character of a rock, and though authority be against him, yet it is the authority of those who admit of a transition class into which they transfer these anomalous occurrences. Now, as no distinctive characters have

tic observation, where the locality and elevation are actually known, can be considered quite decisive of the fact of secondary formations being found at uncommon elevations. For the occurrence of ammonites and belemnites is by no means universally allowed to be characteristic of secondary rocks; and even by that school which asserts their presence to be destructive of the primary character of a rock, they are allowed to belong to the oldest of the secondary, or what they would call, the transition formation.

320. A more curious fact is that of the bones brought from the neighbourhood of the Neetee Pass, and which Mr. Buckland has recognised as belonging to the same era with those of the caves, the history of which he has so ably illustrated.* As this fact would establish the identity of the deposit in which they are found, with that which he has called diluvian, and which is the newest of all the formations, it would certainly be very interesting to settle accurately the locality from which they are derived. But nothing certain is known on this subject further than the negative fact, that they are not to be found south of the Neetee Pass. Hitherto, they have been collected only by natives, whose reports,—never very precise as to particulars the value of which they do not appreciate,—can scarcely be allowed to settle a point of this interest; even their account, however, places them a considerable distance northward of the limits of the zone, marked by the snowy summits of the Himmalaya.

321. Thus then it appears, that at present all we know of certain is, the occurrence of a limestone with ammonites at an elevation of 16,000 feet above the sea, and at no great distance from the boundary of the Himmalaya gneiss. As to the other organic remains, they are brought from beyond our frontier by natives, but neither the distance or the elevation are precisely known. But granting all that these may seem to prove, as to the great elevation to which secondary

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ever been assigned to this class, as have been to the primary and secondary, it is not very unfair to consider this procedure as *something* similar to what is called a *petitio principii.*

* A collection of these bones belonging to Mr. Traill, which I had an opportunity of examining, appeared to me to be perfectly mineralised, judging from their high specific gravity. Now the peculiar character of the diluvium bones is stated to consist in their being not at all, or at least very imperfectly mineralised, differing in fact very little from grave bones of high antiquity, light, porous, and absorbent to the tongue.

formations attain beyond the limits of the tract which is the subject of this paper, it would still be true, that within this tract no such phenomena occur. The great extent covered by primary rocks, and the total deficiency of the trap or volcanic rocks may then serve to express the entire dissimilarity of geological structure between this tract and the Andes,* and I think it a point of considerable interest, and worth insisting on, that no traces of volcanic action,† whether recent or otherwise, has yet been observed in these mountains.

322. We have seen that these primary rocks are always stratified, and that the dip in a great majority of instances is N. E., the direction of the strata being consequently parallel to that of the zone of greatest elevation. The inclination also being small, we may perceive strong grounds for admitting the occurrence of comparatively recent formations at great heights in proceeding along the line of dip. Thus at no very great distance from the crest of the gneiss strata, we may fairly expect, as is the fact, a clay slate, and then a limestone with ammonites, and no doubt did our observations extend further to these, we should see succeeding secondary formations, tertiary, and lastly diluvian, so that upon the whole, there is nothing improbable in the accounts of those who assert the ammonites and belemnites to be found at no very great distance from our frontier.

323. An interesting question is here suggested by the view I have taken of the great central tract combined with this conclusion. We know from Patrin, that the great Altaian chain consists like the Himmalaya of primary formations. Are not these distant and opposite points

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* For this reason I have been at a loss to understand, how analogy had taught us the primary nature of the Himmalaya formations. It certainly appears most natural to compare them with the Andes, in order to deduce analogical inferences. The Andes are not primary, the Himmalaya are so: analogical discoveries *a posteriori*, are always to be suspected.

† There is a foolish notion amongst some of the hill people, however, that the great peak, called Nunda Debee, the highest of the range, and consequently in the world, has been known to emit smoke. They suppose the smoke to be from the gods' Choola or kitchen. It is hardly necessary to add, that there is no real foundation for this opinion. The peak is within 60 miles of Almorah, distinctly visible at all seasons, and had any thing of the kind ever occurred, it must have been seen by some of the European residents at that station. It is, however, worthy of mention, that this peak is scarcely ever seen without a small light cloud resting obliquely upward from its summits; such an appearance might be converted by the crazy imagination of a devotee into smoke ascending from his gods' Choola.

connected on each side by rocks of the same character and eras, and is not the interior from which on one side at least these fossils of such different formations are brought, a huge basin or series of basins in which are arranged secondary, tertiary, and even diluvial deposits, surrounded and supported on every side by a gigantic zone of primary formations?

324. It has I know been disputed, whether the same mountain range or chain be, or be not marked by identity of geological structure. Like many other disputed questions, it is one of words, and the solution entirely depends upon the sense in which we use the word range or chain. If we mean continuous line of elevations, in other words a chain of water heads, such is certainly not marked by identity of geological formation. If again, the line of greatest elevation be understood, then we shall certainly find identity of geological structure, but nothing like continuity of surface. Analogy then adds all its weight to the opinion, that the series of primary formations continues quite round the central plateau.

325. It appears then, that the tract with which we are engaged, comprises a very small part of the outward declivity of a barrier of primary formations, the most extensive probably in the world; that these formations have in this particular quarter, a dip directed N. E. or at right angles to the direction of the tract, and that it is probable the dip continues all round to be also at right angles, that is, towards the centre of the great basin which they surround. The crest of these formations we see attains in more than one quarter to a height of 25,000 feet, rising from plains which have a level of 1,400 feet, and this in a distance of 90 miles. Here then, if any where, we may expect to find some clue to lead us out of the labyrinth of geological speculations and hypotheses; some key to the solution of the great problem concerning the origin of the present inequalities of the earth's surface. Could we but obtain access to all the particulars which are to be learned in these interesting countries, geology would very soon assume a different aspect from that which has as yet distinguished her. Perhaps even the small part of it to which we have access, may furnish particulars calculated to throw some light on the principles of a science as yet in its infancy.

326. Saussure has observed, that in mineralogical cabinets, we see every rock have a definite and easily recognised character. No anomalies

or irregularities occur to embarrass us; none of the transitions or mixtures which are found in nature, and which form the difficulties of the pursuit, "La on trouve tout disposé selon le systeme." The same may be said of our most approved geological systems. There we find every rock occupying its distinct quarter, and no hint of the great and perplexing irregularities with which the student of nature has to struggle at every step. We have granite occupying the lowest and the highest points, a covering of gneiss resting on the granite excepting at the very highest points, mica slate over the gneiss, clay slate over it again, and so on in regular array, and with the outgoings of the newer and newer strata. At lower and lower levels, such an account of things is no doubt very beautiful, very systematic, and indeed has but one fault, that it is not true. As countries have been examined more particularly, it is found, that excepting in a few grand points, not one country will serve for an exact type of another.

327. We have seen that in these mountains,* gneiss occupies the greatest part of the surface. Its thickness is considerable, if we adopt the commonly received opinions of stratification.† To this succeed various schists, the true relations and connections of which are very obscure; micaceous, talcose, chloritic and argillaceous in different places are conterminous with the gneiss. In the schists and in the zone of least elevation, we find a series of patches of granite disposed along a line parallel to that of the direction of the mountain band and strata. Beyond these again, we see an extensive zone of clay slate, in which occasional patches of gneiss also are found, and outside of the whole very limited examples of the secondary strata, which are finally lost in the plains.

328. Here then is a very different arrangement from that just

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* Professor Jameson in one of his latest works mentions the Himmalaya as an example of a granitic chain. It would be interesting to know on what authority he founds his opinion. I have seen more of these mountains than any European, and the only granite within the above tract (beyond which we cannot without great violence apply the term Himmalaya) that I have ever seen consists of fragments in the beds of rivers. I have never had any doubts, and if I had, the occurrence of these fragments would remove them; but that there are occasionally veins and perhaps larger patches of granite as in other parts of these mountains, but I have never within this tract met with any rock, in situ, but gneiss and its contained beds.

† There are, however, some good reasons for rejecting this indefinite continuity of the strata underneath, at least in the direction in which they appear on the surface.

described. The great extent of gneiss, the limited occurrence of granite, its situation in the zone of least elevation, the want of a regular consecutive order in the super-position of the schists; these are sufficient to shew the total dissimilarity of nature and system. But we shall find much greater differences than these, as we descend to the details. It has been supposed, that in every chain of mountains, the strata dip outwards, that is, from the summit the dip on opposite sides is in an opposite direction, and it is obvious that such must be the state of things, supposing the origin of the stratified rocks to be as Werner has taught. But in these mountains this is by no means a description of the fact, for the strata, abstracting local exceptions, have but *one* dip, and that is, on one side towards the chain, on the other from it. The same arrangement obtains in the ghauts of Rewah and Bundlekhund, that is, their dip is only in one direction; and it is worthy of remark, that the precipitous side in that chain is also directed towards the great diluvial valley of the Ganges, which is thus bounded on opposite sides by the perpendicular faces of the strata.

329. Such being the arrangement which obtains, it becomes difficult to understand clearly the order of super-position of the rocks that are found south of the gneiss tract. It is no doubt a very singular feature in the structure of these mountains, and is the more interesting, as being apparently in direct opposition to opinions which have been so generally received. In the accompanying diagram,* it is evident that the gneiss strata at A. prolonged, would be over those at B., which succeed the gneiss in travelling southward, and this remark holds good throughout down to the plains, for the strata always dip conformably or sufficiently near, so as to establish this conclusion. Were the effect to stop with merely placing clay slate or mica slate superior to the Himalaya gneiss, there would not be the actual difficulty; for we know, that within certain limits, there is no exact and universally true order of super-position, though the contrary is stated by systematic writers, (Art. 12.) But in this particular case, the most generally received position in geology would be violated, for by supposing that no dislocation or separation of the strata has taken place, we should have clay slate,

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* We trust, as before stated, that the figures and diagrams will be recovered with the geological map, when we shall not fail to give them to the public.—Ed.

primary limestone, mica slate, and lastly gneiss, all resting, and in this order, on a secondary conglomerate !

330. Are we then to say that this latter is really the case, and that even those facts most generally received, and as yet disputed by no school or sect however sceptical, are often all but partial and local occurrences, and not examples of a general law applicable to every country ? Or is there any way of viewing the subject by which we may escape from so startling a conclusion ? Will any dislocation, subsidence, or elevation of the strata explain the difficulty ? I think not ; for besides the enormous extent of the fault which we must suppose to account for the schistose strata, (at least eight miles in thickness and thirty in breadth,) appearing to dip beneath the gneiss strata, a fault which startles the imagination by its magnitude, we have also to believe, that at each junction of two different formations, a similar fault occurred. This is an assumption evidently gratuitous, and not having even a seeming of probability to recommend it. And in two instances, probably in many more, the appearances as described leave no doubt as to the fact of the newer rocks lying under the older ; that is, if we suppose the strata continuous underneath. In these instances, no dislocation whatever will explain the anomaly. The difficulty appears to me to be real, unless we give up those views of stratification which would identify them with the parallel and consecutive layers of mechanical deposition.

331. It is an opinion gaining ground every day amongst geologists, that the seams of stratification are not always what they have been supposed,—the effect or sign of mechanical subsidence ; and many other facts besides this, militate against the supposition we are considering. Were those layers really deposited from a fluid by the effect of gravity, how are we to explain the sudden changes which are often seen to take place in strata, not vertically, but horizontally, and this repeated often in a very limited space. ? That what is called concretionary structure may sometimes produce parallel seams, we see in the case of those clay slates in which what are supposed to be the planes of stratification, are not parallel with the schistose planes. And that parallel seams, not to be distinguished from those of stratification, may originate in some other cause, is also obvious from the fact so often observed of two, and even three sets of these seams occurring

in the same rock; thus creating a difficulty of saying which is or which is *not* the set indicative of the strata. If we admit then with some of our most celebrated geologists, that in the older rocks the planes of structure have been erroneously attributed to stratification, the difficulty with which we are contending will vanish.* In this case there will be no necessity for inferring a continuation of the strata underneath, and therefore no violation of generally received notions as to the super-position of rocks. The newer formations will rest on the older, and as in this case, the configuration of the surface could not have had any effect in giving the present dip and direction to the upper strata, (for it would have been the reverse,) it is quite clear that neither in these rocks are the seams significative of mechanical depositions.

332. It is at all events very certain that, in all primary countries, the stratification presents various anomalies not easy to be explained on the hypothesis of the formations being mechanical deposits. It is likewise not impossible, that a more particular examination of our mountain strata may suggest some other explanation, or at all events lead us to view it as less contrary to geological observation than I have stated.† With these considerations in view we may for the present consider the order of superposition as determined by the succession of rocks found in proceeding southward, or at right angles to their direction. We will therefore suppose the schists to be deposited on the gneiss, and the sandstones on the schists, notwithstanding the dip being towards the crest of the chain. We have seen, that the two zones into which, on a large view, the rocks may be divided, are parallel with the direction of the mountain land, and with that of the elevated zone, though not with that of the chains, which, as we have before shewn, have no connection whatever with the geological structure.

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* If we could follow their limits with the eye we should probably find the fact to be as now stated, a view of the subject which may tend to explain the apparent inflections and contortions of rocks in general, and perhaps the stratified structure, in all its varieties, may ultimately be considered as resulting from concretion on the large scale.—*Geol. Trans. vol.* 5, *part* 1, *p.* 176.

† See Mr. Weaver's Paper on the Geology of Ireland in the 5th vol. Geol. Trans. part 1. Dr. Macculloch and Professor Jameson appear also to be of this opinion. The latter, however, combines with it a less tenable doctrine, that the Earth may be a large polyhedral crystal, and the planes of stratification its cleavages.

333. In the separation of these two facts,* continuity of elevated ground and identity of geological structure, and which is everywhere so strongly marked in these mountains, we may perceive proof incontrovertible, that the present hydrographical arrangement of the surface has been posterior to the original formation of these mountains; in other words, that their vallies or hollows are effects of denudation, and not of original structure. This conclusion could not be more firmly established, even if we saw the corresponding but disjoined ends of the strata on opposite sides of the valley; such an appearance, however, is by no means rare, as may be seen in the details given in the preceding section. But the proofs need not stop here. For if there be a truth more firmly established than another, by many and various circumstances, it is this of the extensive waste which this surface has undergone, and evidently from causes far exceeding in power any that are now in operation.

334. It is sufficiently obvious, however, that though the system of vallies or drainage, generally speaking, be the effect of denudation, yet we are not to attribute all the irregularities of the surface to this cause. Some it is certain originally existed; some may have been caused by a sinking in of the strata. In the first way, we may account for much of the great depth assigned to vallies in Art. 41. The excavation of a valley of 15,000 feet in depth, and having a slope of nearly 30°, would indeed be incredible whatever force of water we employ, or however long the period we have at our disposal. Even with this abatement, enough remains to stagger our belief. Our incredulity may, however, be softened by recollecting the continually recurring difficulty of accounting for so many openings in the line of the strata, without any marks of displacement or dislocation.

335. There are some facts which, though they throw no light on the manner in which this great change of the surface has been effected, yet are sufficient to shew, that such a conclusion is not to be rejected, even though there may occur a difficulty in explaining all the details. The beds of some of the rivers are, for a part of their course, in the solid

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* One of the first impressions made on the mind in examining the Tortworth district is, that the existing form of the surface appears to a certain extent to be unconnected with the nature of the rocky formations that compose its base, an observation indeed that may admit of almost universal application, and be deemed a maxim in Geology.—*Mr. Weaver Geol. Trans. vol.* 1, *p.* 319.

rock. In these cases, the depth is often considerable, while the appearance is such, as leaves not a doubt in the spectator's mind, but that the present channel was once filled up with solid rock. This is a conclusion we cannot escape from, however difficult it may be to understand the removal of so many thousand cubic feet of solid rock by the agency of water.

336. In all the river beds too we see that there are accumulations of gravel and boulder stones, all perfectly rounded, and consequently all of them such as have been subject to the action of water. These collections, it appears from the details I have given, are in many cases of very great extent, and frequently occur at a height of even 300 feet above the present bed of the river. That these collections should ever have been formed by such bodies of water as are found at present in their vicinity, is altogether inadmissible. Their extent, the size of the fragments, the distance from which they are derived; above all, their great depth, and the height at which they are found above the present bed of the river, all forbid so incredible a supposition.

337. Even if we could get over these difficulties, and really believe that rivers, which in their greatest power at the present day cannot move one of these fragments a few feet, did yet in former ages, transport for many miles, several thousands, nay millions of them, and accumulated them in heaps many times exceeding in height the greatest depth of the said rivers; even if we could get over the difficulties, yet others greater remain. The tract defined in Art. 71, called the Bhabur, we have seen equally consists to a vast depth of these water-worn fragments, evidently of the same era, derived from the same rocks, and transported by the same causes; so also the several plains or vallies described in Art. 57, *et seq.* contain immense beds, the same in every respect with those found in the river vallies. These it is evident, could never have owed their disposition to the power of rivers, whatever may be said of the former comparatively limited accumulations; because they are found where at present no rivers flow.

338. That there is some connection, however, between the disposition of these beds of gravel and formation of the river vallies, appears evident from the following fact:—In establishing a series of bores along the terrace, I found that the distance from the common boundary of plain and mountain land at which gravel was found, was greater in the beds

of rivers, or in their banks, than on the intermediate ground. Whatever therefore the cause which accumulated these beds of water-worn fragments, we see that it acted with greatest force in the direction of the river vallies.

339. There is another very striking fact which enables us to limit still more precisely the direction in which these fragments travelled. At Hurdwar, it terminates rather suddenly in the low range of hills, which bound the Dehra Doon to the southward. These hills, as I stated in Art. 61, form an uninterrupted chain or line of water-heads, on each side of which they are intersected with deep gorges now the beds of torrents. Those which open to the Doon, it appears, are strewed with fragments of the same kind as those which cover the valley itself; but those which open plainward, contain no fragments but of the rocks in situ, which it also appears are of an entirely different character, and not possible to be confounded. The deposit seems, however, to have continued along the foot of those hills, and even to have left fragments at the mouths of the gorges; but in no case do they extend to any distance upwards.

340. These deposits have been observed in every country in which as yet geological investigation has been carried on, lying at the foot of mountains, and often covering extensive plains, or scattered over the bottom of vallies. Perhaps in no country can they be seen on so large a scale as in these districts. The enormous extent of the bed comprising the Bhabur, and filling up the several vallies, is alone enough to excite all our wonder. They have everywhere been recognised as witnesses of the progressive nature of the changes that have affected the surface of the earth. They have established the fact of at least two eras, that of the original formation of these mountains, and the subsequent extensive denudation of the surface forming the present system of vallies. But from considering all the circumstances of the case a still greater discrimination may be made. It is almost certain, that they owe their present arrangement to some sudden and violent catastrophe. Now, it is not likely that their rounded form, being as they are amongst the hardest of stones, was given them by any other than a cause operating through a considerable period of time. Here then we have proof of a series of actions, which must have been posterior to the formation of the original strata, and which carries up the latter to a still higher antiquity.

341. Nor is this question affected by the doubt as to the origin of these boulders; that is, whether they have proceeded immediately from the debris of the primary strata, or immediately been formed into secondary conglomerates. It is remarkable, that the nature of the stones is the same in both deposits, the secondary rocks and the diluvium; the only difference being in arrangement, the former being distinctly stratified, and passing into well-defined micaceous sandstone, while the latter forms a confused heap of gravel, in which stones of all sizes and even angular fragments sometimes are found. That they have originated in the breaking up of secondary strata, is I think, the most probable, although we shall then be puzzled to account for the deposits in the beds of rivers where now no secondary rocks are to be seen. However this may be, it is still worthy of remark that the greatest accumulations are found where the secondary formations still exist.

342. Granting that some such catastrophe in these mountains as a mighty *debacle*, or rush of waters, must have given these beds of diluvium their present place, we shall see strong reasons for supposing, that for a time these waters have been pent up in the Doons or vallies, which extend along the frontier. Have they subsequently broke through this range by their own accumulated pressure, or has any other cause of change assisted in finding an outlet for this series of lakes? The reversal of the dip on the opposite sides of the river at Hurdwar, is a curious anomaly occurring in such a place, and must, I think, strike every one. Till all the circumstances be known, it is vain to speculate. Whether such fact or any disturbance of the strata is to be observed at the other *debouches*, will be interesting to determine.

343. The theory which has identified this rush of water, traces of which have been found in every part of the globe, with the deluge, as described to us in the Scripture, and which has derived its chief illustrations from the labors of Cuvier and Buckland, has been strongly opposed by the geologists of Scotland. In particular, Dr. Fleming has stated some difficulties with regard to the subject, not easily got rid of. He has shewn, that the silent and quiet rising of the waters, and their equally gradual subsidence, as deducible from the account of Moses, cannot be confounded with a cause which has evidently been sudden, vast, and overpowering. The former we see did not even abrade the surface, for vegetation, and trees even, still remained, whereas

the latter has torn up a vast mass of consolidated strata, scattering their ruins over an extent of many hundred square miles.

344. Granting, however, that these attempts to find a geological theory in the sacred records have been as hasty as ill-judged, we shall not find Dr. Fleming more successful than those whose labors he has overturned, in explaining the phenomena in these mountains. With him it is merely the bursting of a series of lakes, and the diluvium is in his nomenclature, lacustrine silt. The mere alteration of the name is of little signification, nor does it lead us a step further in our search after truth. But here is no series of lakes, no vallies that might conveniently be supposed beds of lakes. The only vallies in the several Doons are beyond the limits of many of the phenomena which their bursting is to explain. Were our geologists always satisfied with shewing what is *not* the cause, the science might make more progress than it has done, but one theory is no sooner laid than another rises to supply its place.

345. In reality, our chief object should be in the first instance to collect facts from every quarter. If the explanation is to be general the induction should be equally so, as well as the data on which it is founded. Our limited acquaintance with the surface of the earth will not allow of our generalising as yet with safety, and it will be constantly found, that the hypothesis invented to explain the phenomena in one country, will be overturned by facts observed in another. Dr. Fleming, in his hurry to establish his own view of the subject, has certainly confounded two distinct, and in many cases, easily recognised classes of appearances; and in truth, the whole of what Professor Buckland has advanced in his Reliquiæ Diluvianæ remains untouched, (because it is observation,) excepting his notion of the identity of the cause, the effect of which he has so ably traced to the deluge of Scripture. I need hardly add, that the phenomena in these mountains have a most striking analogy with those detailed in the above work.

346. The hasty generalisation which produced the Wernerian system of geognosy has long been acknowledged, and the fact established that few countries, even belonging to the same formation, present exactly the same arrangement and succession of rocks. The opinions of some geologists have even taken the other extreme, and it has been questioned whether there be any such thing as a general formation quite round

the globe; a continuous one there probably is not, but when we view amidst all the differences that undoubtedly do occur in the super-position and connections of rocks, the many and wonderful coincidences that still remain, not confined to a spot of limited extent, but *clearly* belonging to the whole *tract*, we shall be satisfied that the contemporaneous formation cannot be predicted of these masses in which such resemblances are found; at least they must be attributed to a common origin. When we read in Humboldt, that while in different countries, different plants and animals present themselves to the observation of the naturalist, the rocks are the same in every zone; in every climate we appear to be engaged * * * * *
* * * known list of minerals might be formed, we have so small a catalogue of compound rocks, and these always the same wherever occurring, why should granite always contain quartz, mica, and felspar, and always nearly in the same proportions, however distant the localities? mica slate, mica and quartz, and so on of others. These are questions difficult to answer, but which none can avoid asking themselves who have ever reflected on the subject.

347. In all the grand features of geological character * *
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* * [*] Himmalaya does not [*coincide*] it is true with that [*of the*] Andes. But it bears a [*very*] close resemblance in general features to the description given us by Dr. Macculloch, of the Western Isles. As on those Islands, so here we recognise the great extent of gneiss occupying in each system the middle and highest tract. In the great deficiency of granite, we see another resemblance and a common difference from the dogmas of the schools, that the highest part of every system of mountain * * * * *.
* * * impossibility of discriminating in this point between the primary and secondary rocks. But the most interesting coincidence, at least to me, is in the arrangement of the schists, and their connections with the other rocks. In his chapter on the chlorite series, he has almost completely anticipated every thing I had to say on the chlorite schists of the Himmalaya.

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[*] A quarter of a page, or more, is wanting, where this and the following lacunæ occur, and there is no clue by which even to guess at the writer's views.—Ed.

348. The existence of coal all over the world, and always in the same geological situation, is another proof that even in * * * * * * * condition or state of things, which must have been common to every country of the globe. Pursuing the analogy taught by the facts learned in the coal fields of England, that valuable mineral has been brought to light in almost every part of the world, it may not therefore be uninteresting to enter into some little explanation on this subject, in order to judge whether the deposit may be expected in this quarter, as in any way connected with the series of facts described.

349. The coal formation though, as has been observed, owing its origin most probably in every country to the action of some general cause, may yet be considered, as far as appearances are concerned, to be a local deposit, inasmuch as it is always of limited extent compared with the other strata. Its place in the system is well marked, nor has any bed of coal worth mention ever been found out of that place. It is known to overlie a limestone, which from its relation to the coal, has been called carboniferous, and which itself lies upon the rock called the old red sandstone, the lowest of the secondary strata. Above the coal measures is found the newer red or saliferous sandstone. Between these two members of the series, it has always been observed to hold its place; subordinate strata occasionally intervening, occasionally being wanting, but the coal never occurring, that is, in any quantity above the latter, or below the former rock.

350. This would seem to be a sufficiently definite arrangement to enable us always to pronounce on the greater or less probability of finding this useful mineral in any tract in which the succession of rocks has been accurately traced. Applying the principle to the present survey, it will be found that limiting facts are wanting, although the general presumption is strongly in favor of the existence of a coal formation. Thus we have the saliferous or newer red sandstone on the border of the mountain tract, dipping N. E., giving the promise of older or inferior deposits to the Southward; and again at Dehli, we have the old red sandstone, leaving it a natural inference, that in the intermediate space, intervening formations will be found.

351. The great coal field of Northumberland and Durham is situated in millstone grit and limestone shale (the upper anomalous beds of the

old red sandstone,) on the outside of which small patches occur of the newer red, and beyond that, a country of schistose formation. On one side it has the mountain or carboniferous limestone, and outside of it, a large band of the red sandstone, part of a mass which occupies the centre of England. The coal field of Wales is separated from the old red sandstone by a narrow strip of the carboniferous limestone. Those of Staffordshire are similarly situated with those of Northumberland. The coal field near Burdwan is covered by the newer red sandstone; all these facts, I think, give a strong probability to the opinion, that coal will be found in the Dooab. The facts that are wanting are such as would limit its position, and consequently give a well-grounded prospect of discovery, before commencing any thing like an expensive search. These facts will be furnished by the prosecution of the survey.

The concluding section of this Report is that upon the Mineral Productions of the Himalaya, which will be found in Vol. XVIII, Part I. p. 227 of the Trans. As. Society.—Ed.